ELECTRONICS & TECHNOLOGY TODAY!

Canada's Magazine for High-Tech Discovery

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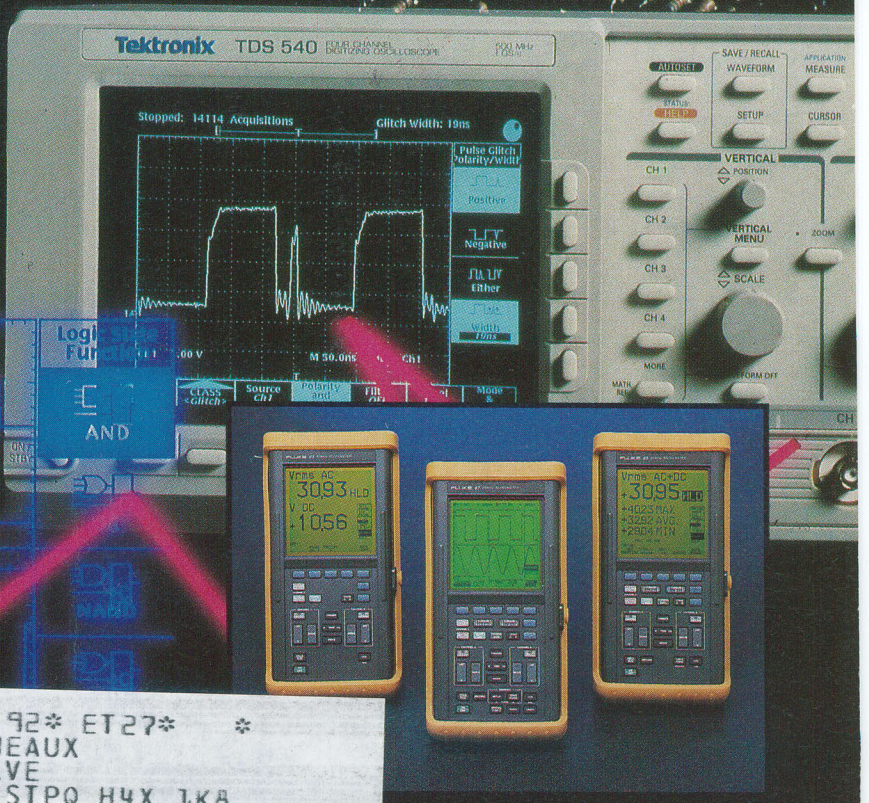
Build a Surround Sound Decoder

Almost Free Software of the Month

Understanding Sound Waves



...ope Meters From Fluke
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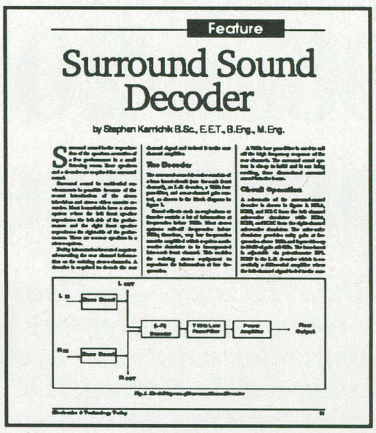
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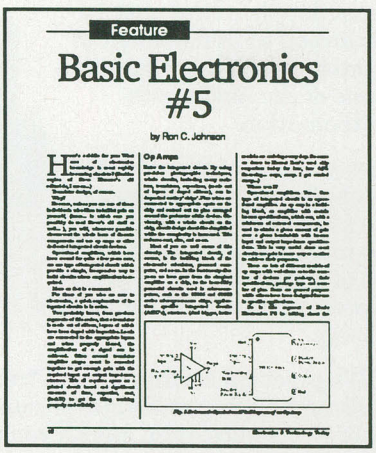
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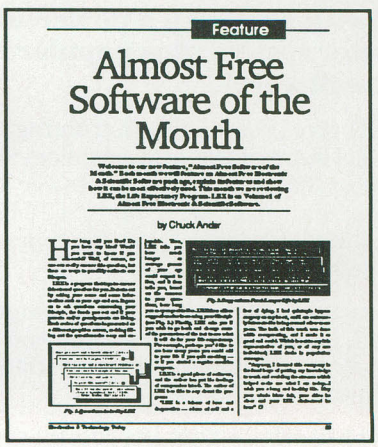
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Almost Free Software of the Month
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Learn to troubleshoot and service today's computer systems as you build a 386sx/20 MHz mini tower computer!

Train the NRI way—and learn to service today's computers as you build your own 386sx computer system, now with 1 meg RAM, 40 meg IDE hard drive, and exciting new diagnostic hardware and software!

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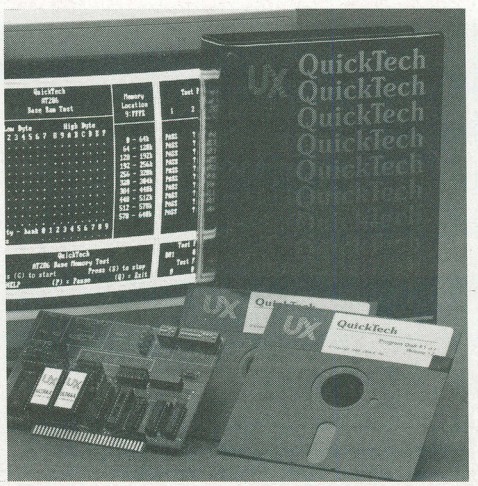

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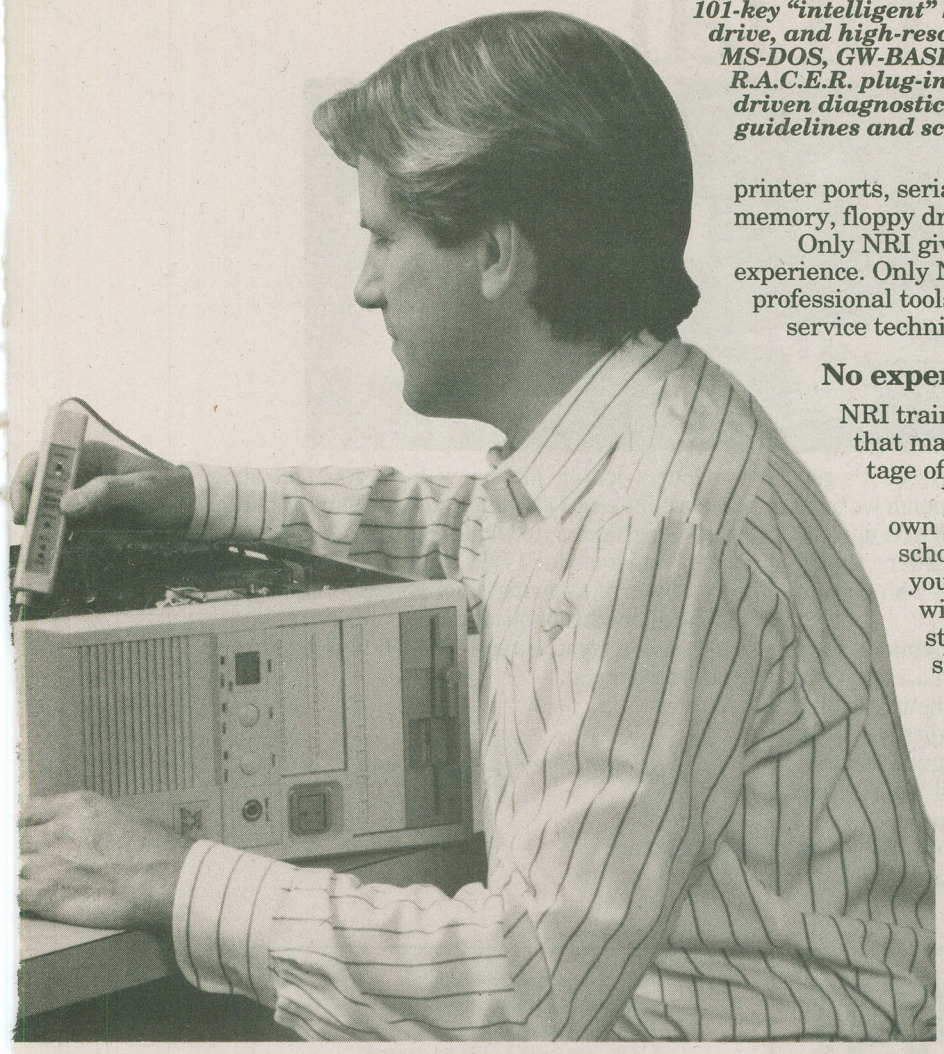

printer ports, serial communications ports, video display memory, floppy drives, and hard disk drives.

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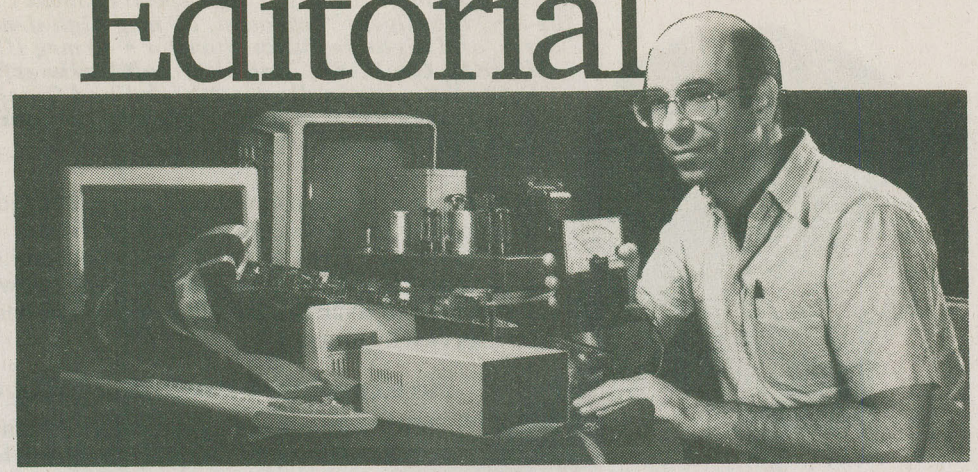
Editorial



Well, Fall certainly has arrived; it's getting **cold!** outside. This month we have some great stuff to warm you up. The **Surround Sound Decoder** should prove invaluable to those on a budget who wish to augment their home theatres.

We have started to feature an **"Almost Free Electronic & Scientific Software"** package each month. The first one to be written about is called **LEX**, a program that attempts to predict how long you will live. And in addition to our regular features, you can read about and experiment with sound waves and methods of measuring them.

I'm going to ask you for letters again — not letters to the editor, (although they are always welcome) but letters letting me know how you feel about ***Electronics and Technology Today*** and containing your suggestions as to what should be included in the upcoming issues for 1992. Your letters are the only way I have of knowing what you are thinking and feeling about this publication.

So have a great Autumn and I'll look forward to hearing from you.

Chuck Ander
Editor

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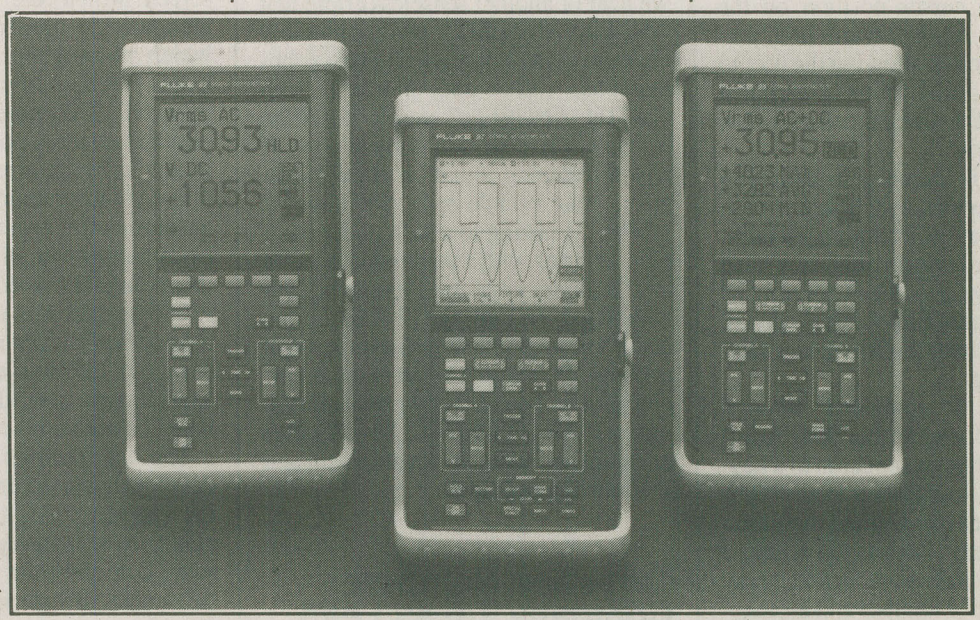
New Products

New Fluke ScopeMeters Combine Oscilloscope and Multimeter in One Package

A new series of handheld service instruments combines a dual-channel digital storage oscilloscope (DSO) with a feature-packed digital multimeter to bring extensive measurement capabilities in a rugged, sealed package to field service environments.



The 93, 95 and 97 ScopeMeters offer sophisticated oscilloscope features with powerful digital multimeter functions, while maintaining ease-of-use through such features as AUTOSET, waveform and setup memory, combined display of meter results and waveforms, convenient menus and softkeys. The top model also features a built-in signal generator, component tester, optically isolated RS-232 remote control and printer interface, and backlit display.

The Fluke ScopeMeters provide a 50 MHz bandwidth and a 25 megasamples per second (MS/s) sampling rate, the fastest speeds of any handheld scope on the market. Additional oscilloscope functions of the 90 Series include a 40 ns glitch capture time to catch intermittent failures and storage capabilities of up to 8 waveforms and 10 setups, making testing faster and easier. The 90 Series also offers AUTOSET, which automatically sets volts per division, time per division, position and triggering controls of any scope input signal. In the METER mode, AUTOSET automatically tracks the input signal for the proper range, time per division display, and triggering.

Extensive multimeter capabilities are provided along with additional features: diode test; Min Max recording, which provides simultaneous display of maximum, minimum, average and present readings; Touch Hold®; relative and percent-relative modes; dBm, dBV, and dBW readings; and autoranging. With the included probes, the ScopeMeters are capable of floating (isolated) high voltage measurements to 600V rms, making them suitable for a broad range of high energy three phase applications. The same probe is used for both oscilloscope and multimeter voltage measurements.

Simple operation of all ScopeMeter features is enhanced by five function keys, which allow the user to easily find and select different functions of the instrument. Pop-up menus provide the user with a clear guide through the ScopeMeter's capabilities.

Lightweight (4 lbs/1.8 kg with holster), handheld and constructed in a rugged, sealed industrial package, the ScopeMeters are suitable for use even in harsh environments or remote locations. The LCD is easily read in low light situations with the backlighting capability on the model 97. The battery-operated instrument runs on either rechargeable nickel-cadmium (NiCd) batteries (included) or common alkaline C-cell batteries. Included with each ScopeMeter are probes which come with high voltage and high frequency tips, an ac line adapter, a built-in battery charger, a holster and a tilt stand that can be adjusted to hang over a panel or door.

An optically isolated RS-232C interface is standard on the 90 Series for instrument calibration. With the model 97, the RS-232C interface can be used for remote control, to read waveforms and setups, or to print the display. The ScopeMeters also function as a generator with three waveforms (sine, square and ramp). A current or voltage output component tester mode provides a simple test signal for checking circuits, op-amps, transistors, diodes or other devices. Prices for the 90 series range from CAN. $1,295 - $2,100 (duty and taxes extra).

Circle No. 12 on Reader Service Card

Optical Head Pointer Enables People with Disabilities to Use Computers

University of Toronto researchers have developed an optical head pointer that will allow individuals unable to use the standard mouse, trackball and keyboard to have hands-free access to computers.

The Long Range Wand (LRW) consists of a lightpen device worn on the head which directs the screen pointer through head movement. As the head moves, the screen cursor moves in direct relation.

The button action of the mouse is achieved through head gestures and pause times. For example, by pausing for a brief time at a desired point the user selects a cursor position on the desired icon. A downward nod performs a single click allowing the user to enter a particular function. Continued pausing initiates dragging to move or resize a "window."

"The LRW is the only headpointing device that provides switcheless emulation of a mouse. Individuals with high-level spinal cord injuries who lack hand control but have good head control can now easily operate computers," said Gil Hamann, a graduate student in biomedical engineering.

Text input is provided through WiViK (Windows Visual Keyboard) — an on-screen representation of a keyboard which allows access to any Windows 3.0 application without modification. A keyboard is displayed within a movable, resizeable window and it may be customized for number and arrangement of keys. Together the LRW and WiViK provide total keyboard and mouse emulation.

The research, conducted at the Hugh MacMillan Rehabilitation Centre, was funded by the University Research Incentive Fund of the Ontario Ministry of Colleges and Universities, IBM Corporation and IBM Canada Limited.

For more information contact: Gil Hamann, Hugh MacMillan Rehabilitation Centre, (416) 425-6220 Ext. 548 or Kim Luke, U of T Public Affairs, (416) 978-2105.

Circle No. 13 on Reader Service Card

Canadian Product: May Be Key to Lower Auto Insurance Rates

With auto theft estimated to be costing Canadians 750 million dollars a year, a new, appropriately named crime-fighter, "AUTO-ANGELL," might be just what society needs to reduce auto insurance costs, and drastically reduce the number of violent crimes involving automobiles. When "AUTO ANGELL," a small black box is installed out-of-sight under your vehicle's dashboard, no unauthorized person will be able to drive your car for more than 42 seconds — even if they have the keys, "AUTO ANGELL" never has to be armed or turned on; it's always on, always working. It seems that every day we hear of another senseless crime that "AUTO ANGELL" could possibly have prevented; high-seed chases, abductions, rapes and murder. With "AUTO ANGELL," you'll never be forced to drive anywhere by anyone. If any threatening situation should ever arise, your vehicle will stall after 42 seconds, coasting to a stop under complete control with operational steering and braking systems. Attempted unauthorized re-starting will be to no avail. The engine will turn over but will not start. Developed by an ex-commercial pilot and present day private investigator, "AUTO ANGELL" has 2 years of extensive research, development and field-testing behind it.

Canadian Computer Company Takes Lead in Developing Software for New Pen-Based Computer

Toronto's Filbitron Group of companies is one of the few Canadian organizations to take the lead in capitalizing on what computer experts predict will be the fastest-growing industry technology ever — pen based computing. The company has announced it is developing applications for Ohio-based NCR Corporation's System 3125, a pen-based electronic notepad which is able to recognize handwriting.

"The growth potential of pen-based computing is enormous because it will benefit a diverse market of 25 to 50 million mobile North American professionals who currently don't use a computer," said Doug Smith, President of Filbitron, one of the country's leading software developers. "Pen-based computing, supported by the software we're developing, is truly user friendly and will also appeal to people who are now afraid to use computers and keyboards; simply, if you know how to write, you know how to use this machine."

Similar in size to a clipboard and weighing less than two kilograms, the pen-based computer is geared toward people who now rely on traditional means of writing on paper to take notes, fill out records or produce reports. There is no typing required: with the machine's special pen, called a stylus, users print characters directly on the screen which the computer in turn recognizes, transforms into letters which the computer then processes and stores in a memory bank for easy retrieval. This saves users time and eliminates any possible errors that might have occurred had they transferred the information from writing pad to computer. Words are changed simply by circling them, erased by scratching them out and moved by drawing a line to another place on the screen. Because the computer is portable and durable (it has the potential to endure under-water and sub-zero conditions, for example), it can be used anywhere.

The applications Filbitron is now developing can be tailored according to the specific needs of any occupation, company or industry. For example, the same core program can be adapted to serve such diverse functions as: police department incidence reporting, public utilities field recording, retail stock control, patient care, field sales, real estate recording, and teachers' day book.

"There are literally hundreds of software packages that can and will be developed," Smith said. Filbitron will demonstrate some of the capabilities of its pen-based software at this fall's Canadian Computer Show and Conference in Toronto.

Smith predicts pen-based computing is only the beginning of an explosion in modern technology. "Within three to five years, pen-based computers will take a significant chunk out of the personal computer marketplace," he said, adding that "by the end of the decade,

even more simple and dynamic ways of inputting data, such as by voice, will begin to be developed which will totally change the relationship between people and computers."

Despite the initial $6,000 (Cdn) price tag for pen-based computers, Smith explained that the cost will inevitably decrease to the sub-$2,000, personal computer price range. "Wireless office automation is the way of the future and will eventually change the nature of the workplace. Because pen-based computers are mobile, user-friendly, durable and easily integrated with other communications systems, they will become widely used and we'll see a greater range in price with the development of different models," he said.

Circle No. 14 on Reader Service Card

New, Rugged, Noise Dose Meter Fits in Pocket

A new noise dose meter which accurately measures sound exposure yet is rugged enough to withstand the most hostile industrial environments has been introduced in Canada by Bruel & Kjaer.

The Type 4436 dose meter differs from other such instruments in that the sensitive microphone is encased in the body of the instrument making it virtually impervious to harm from impact or other hazards. Noise is gathered through a specially-designed acoustic tube.

Other instruments designed for this purpose often run into problems because external microphones break down under normal work stress.

Because the instrument is so small and light, it can be carried in a shirt pocket and will accurately track noise events wherever the wearer goes in mills, factories, offices and other worksites.

Specially created software, the BZ 7028 allows data from the instrument to be downloaded into a regular PC for analysis or data logging. In this way, problems with noise exposure can be solved before they become an annoyance or even a danger to workers.

The 4436 is also a Type 2 integrating sound level meter conforming to international standards set for this class of instrument.

Circle No. 15 on Reader Service Card

Seeing A Sound Wave

A way to "see" the effects of sound waves in loudspeakers has been devised by British researchers.

The scientists, at Celestion International in Ipswich, eastern England, are using a laser, as seen here, and a specially programmed computer to achieve a more accurate method of assessing performance of speakers and cabinets.

For the past 50 years the moving coil speaker has probably changed least of all major audio components.

Manufacturers striving to produce speakers which correctly imitate the vibrations of live sound have until recently had to use indirect measurement techniques for evaluating speaker performance. These analyzed the sound created — rather than the process that results in the sound waves.

Best known of these conventional methods of measurement is the amplitude response curve. Using microphones in an anechoic chamber this test gages the sound pressure of a speaker's output across the audible frequency range. Ideally, a speaker should emphasise all frequencies equally, resulting in a "flat" response curve and reproducing all of the music signals perfectly accurately.

But these tests still cannot guarantee that a speaker would actually sound good — sometimes two speakers with similar amplitude response curves can sound completely different.

The system developed by the team at Celestion, a company which has been building loudspeakers since 1924, shows speaker or cabinet vibrations in animated form, clearly and unambiguously. Operating in three steps it

first uses a computer to instruct a neon-helium laser to scan the surface of a vibrating speaker diaphragm, gathering information on motion at more than 48,000 points. Then a phase-sensitive detector gathers the data and relays it to the computer, where it is processed and fed to an X/Y plotter. This draws a three-dimensional picture of movement as it appeared at the instant of the laser scan.

Successive plots are stored in the computer and can be displayed later on a computer screen as a three-dimensional moving picture, providing a clear indication of the direction of surface waves. Looked at in this way speaker and cabinet vibrations make a great deal of sense, and speaker "misbehaviour" is much more apparent. For example, after considerable observations the researchers realised that a basic problem with speakers was that they had too many parts, joints and boundaries, each vibrating differently. Problems could also arise from long-accepted assembly techniques.

The system is being used in research to find new materials from which to construct speakers and cabinets and to improve designs so that they will vibrate simply, purely, and more faithfully to the original sound. ❐

Circle No. 16 on Reader Service Card

Surround Sound Decoder

by Stephen Kamichik B.Sc., E.E.T., B.Eng., M.Eng.

Surround sound is the reproduction of the spacious acoustics of a live performance in a small listening room. Rear speakers and a decoder are required for surround sound.

Surround sound in residential environments is possible because of the recent introduction of the stereo television and stereo video cassette recorder. Most households have a stereo system where the left front speaker reproduces the left side of the performance and the right front speaker reproduces the right side of the performance. There are no rear speakers in a stereo system.

Dolby laboratories invented a system of encoding the rear channel information on the existing stereo channels. A decoder is required to decode the rear channel signal and to feed it to the rear channel amplifier.

The Decoder

The surround-sound decoder consists of a bass boost circuit (one for each front channel), an L-R decoder, a 7kHz low pass filter, and a rear channel gain control, as shown in the block diagram in figure 1.

Sound effects such as explosions or thunder contain a lot of information at frequencies below 50Hz. Most stereo systems roll-off frequencies below 30Hz; therefore, very low frequencies must be amplified which requires a subwoofer simulator to be incorporated into each front channel. This enables the existing stereo equipment to reproduce the information at low frequencies.

A 7kHz low pass filter is used to roll off the high frequency response of the rear channels. The surround sound system is cheap to build and it can bring exciting, three dimensional surround sound into the home.

Circuit Operation

A schematic of the surround-sound decoder is shown in figure 2. IC1A, IC1B, and IC1C form the left channel subwoofer simulator while IC2A, IC2B, and IC2C form the right channel subwoofer simulator. The subwoofer simulator provides unity gain at frequencies above 1kHz and it provides up to 28dB of gain at 10 Hz. The bass boost is adjustable via potentiometer RP1.

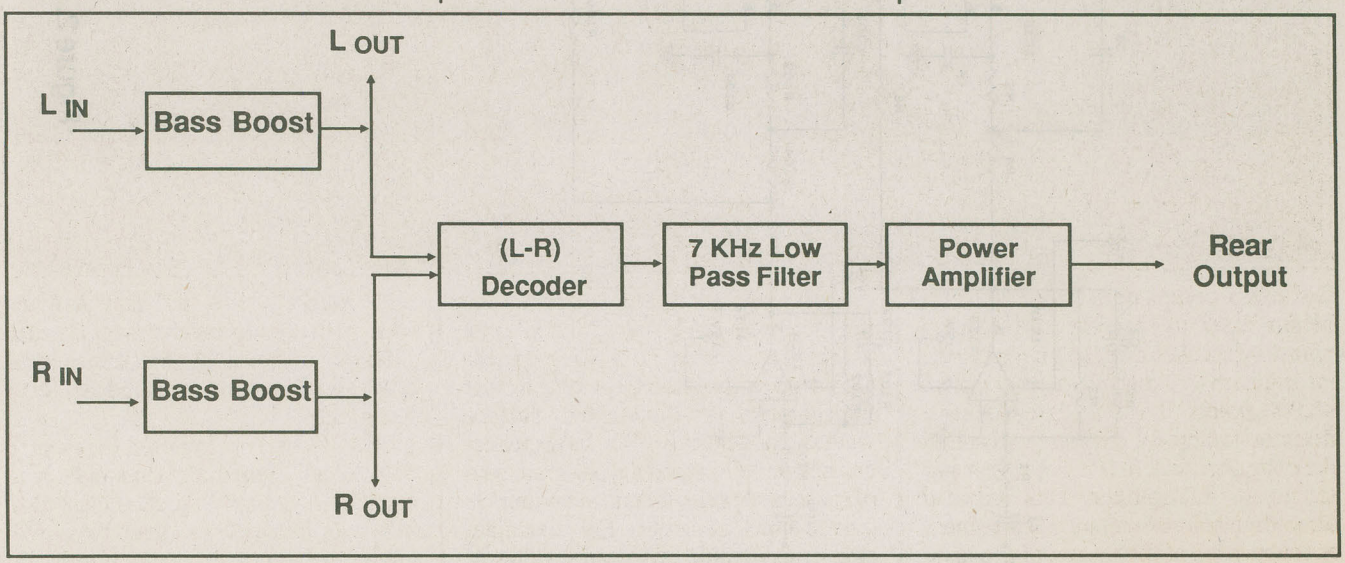


Fig. 1. Block Diagram of Surround Sound Decoder

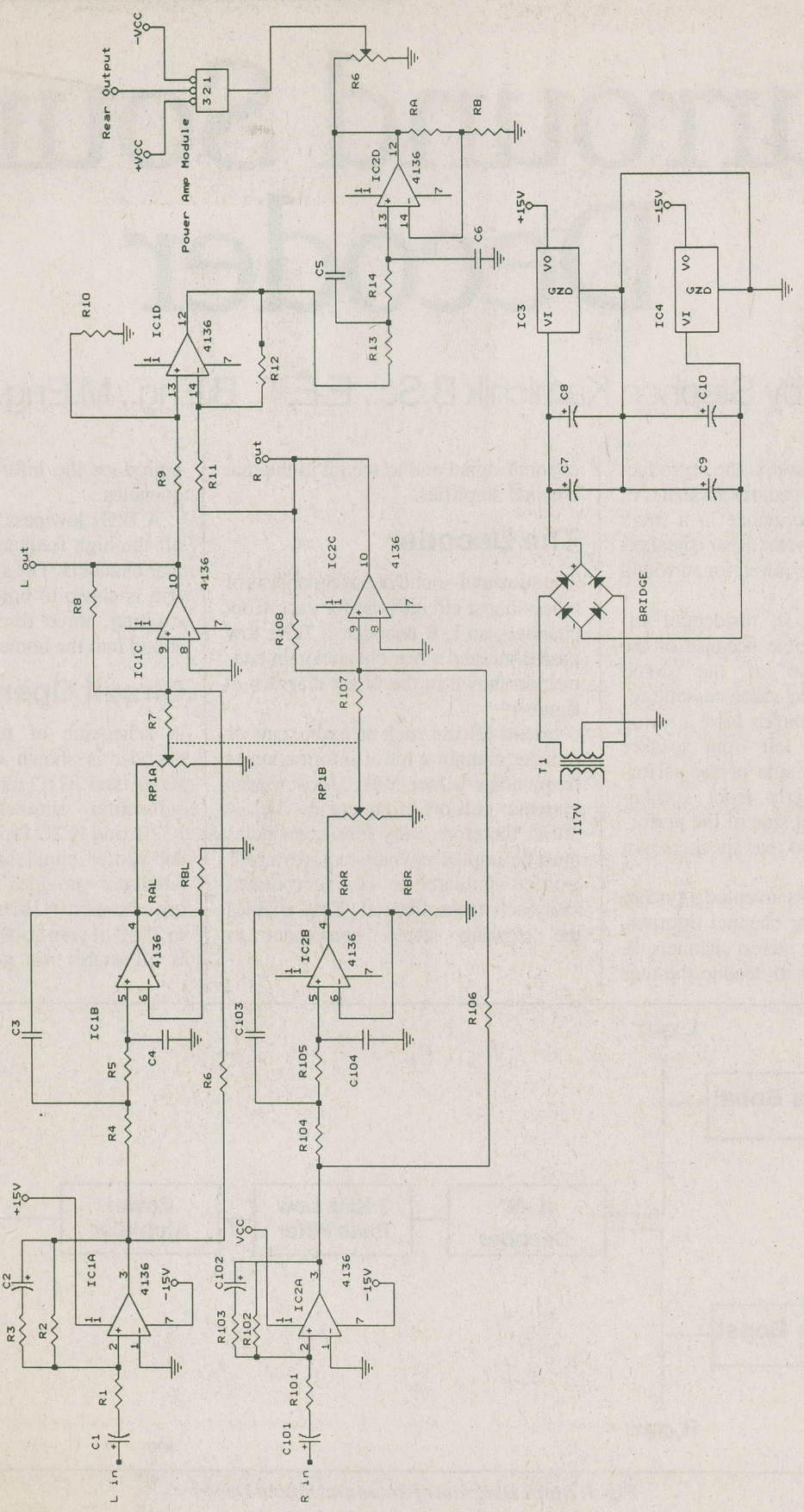


Figure 2. Schematic Diagram of Surround Sound Decoder

JOIN THE EVOLUTION

The major Canadian PC event of 1992 begins on March 23rd at the Metro Toronto Convention Centre.

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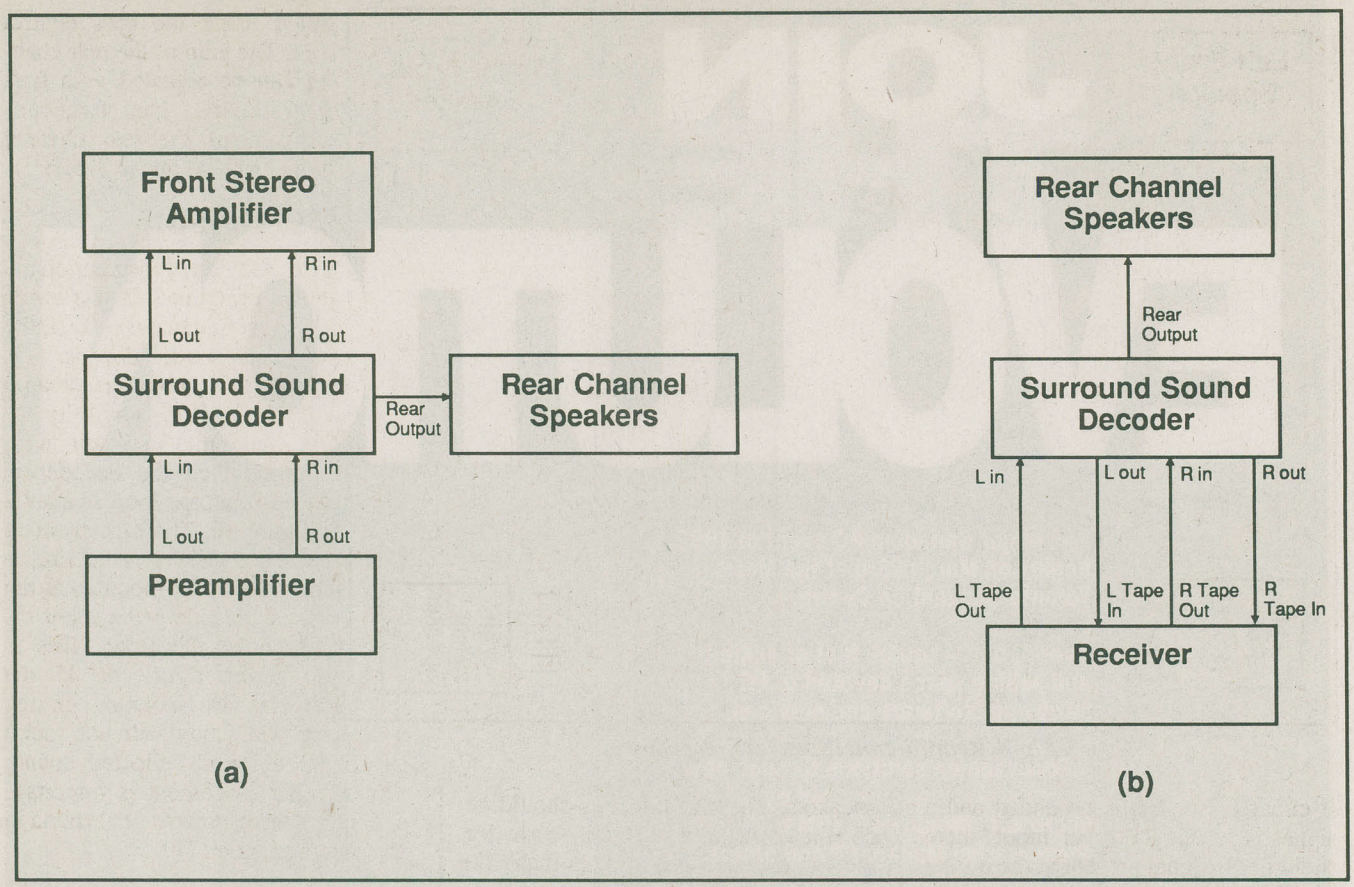


Fig. 3. Installation of Decoder Into Stereo System

IC1D is the L-R decoder which is essentially a differential amplifier where the left channel signal is fed to the non-inverting input of the operational amplifier and the right channel is fed into the inverting input of the operational amplifier. IC2D is configured as a 7kHz low pass filter. The power amplifier can be any amplifier module capable of driving two eight ohm speakers in parallel. The remaining components make up a dual power supply required to power the system.

Construction

The surround-sound decoder may be built on a piece of perf board using point to point wiring or on a printed circuit board. Each RC4136 operational amplifier contains four separate op-amps. Alternately, eight LM741 op-amps may be used as long as the proper pins are used for the inputs, output and power supply leads. Care should be taken to orient the capacitors properly and to avoid solder bridges. The power amplifier module may be any power amplifier that can drive two eight ohm speakers in parallel. A good choice is the ILP-HY60 available from Plitron Manufacturing Inc. at (416) 667-9914. Active Components also carrys this amplifier module. Active can be reached at 1-800-363-6592.

Parts List

all resistors are 1/4 watt @ 5%

R1,R101: 47k

R2,R102: 270k

R3,R103: 56k

R4,R5,R104,R105: 33k

R6,R8-R12,R106,R108: 10k

R7,R107,RA,RAL,RAR: 1.8k

RB,RBL,RBR: 3k

RP1: 100k dual potentiometer

R13,R14: 22k

RG: 5k potentiometer

C1,C101: 1.0 µF

C2,C102: 0.047 µF

C3,C4,C103,C104: 0.1 µF

C5,C6: 0.001 µF

IC1,IC2: RC4136 (ECG 997)

IC3: LM7815

IC4: LM7915

D1-D4: 1N5408

C7-C10: 2500 µF @ 25V

T1: 25.2 V.C.T. @ 2A transformer

Power Amp Module: see text

Testing

Testing of the decoder is straight forward. Connect the same signal to L_{in} and R_{in}. There should be a signal at the output of IC1C and IC2C. There should be no signal at the output of IC1D and hence no sound from the rear speakers.

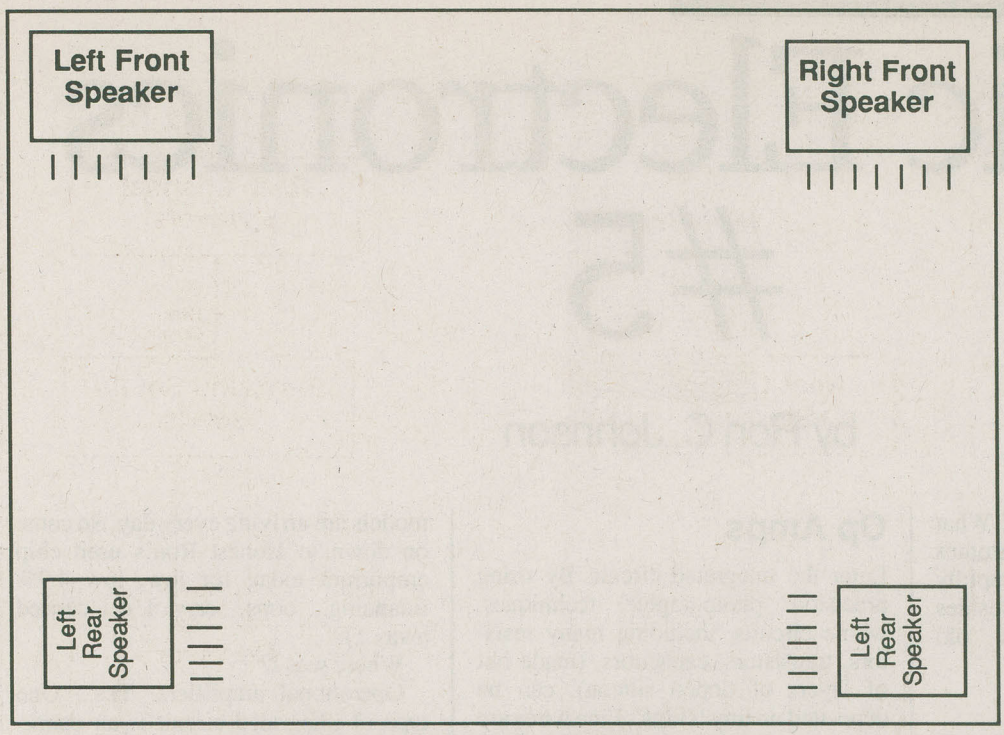
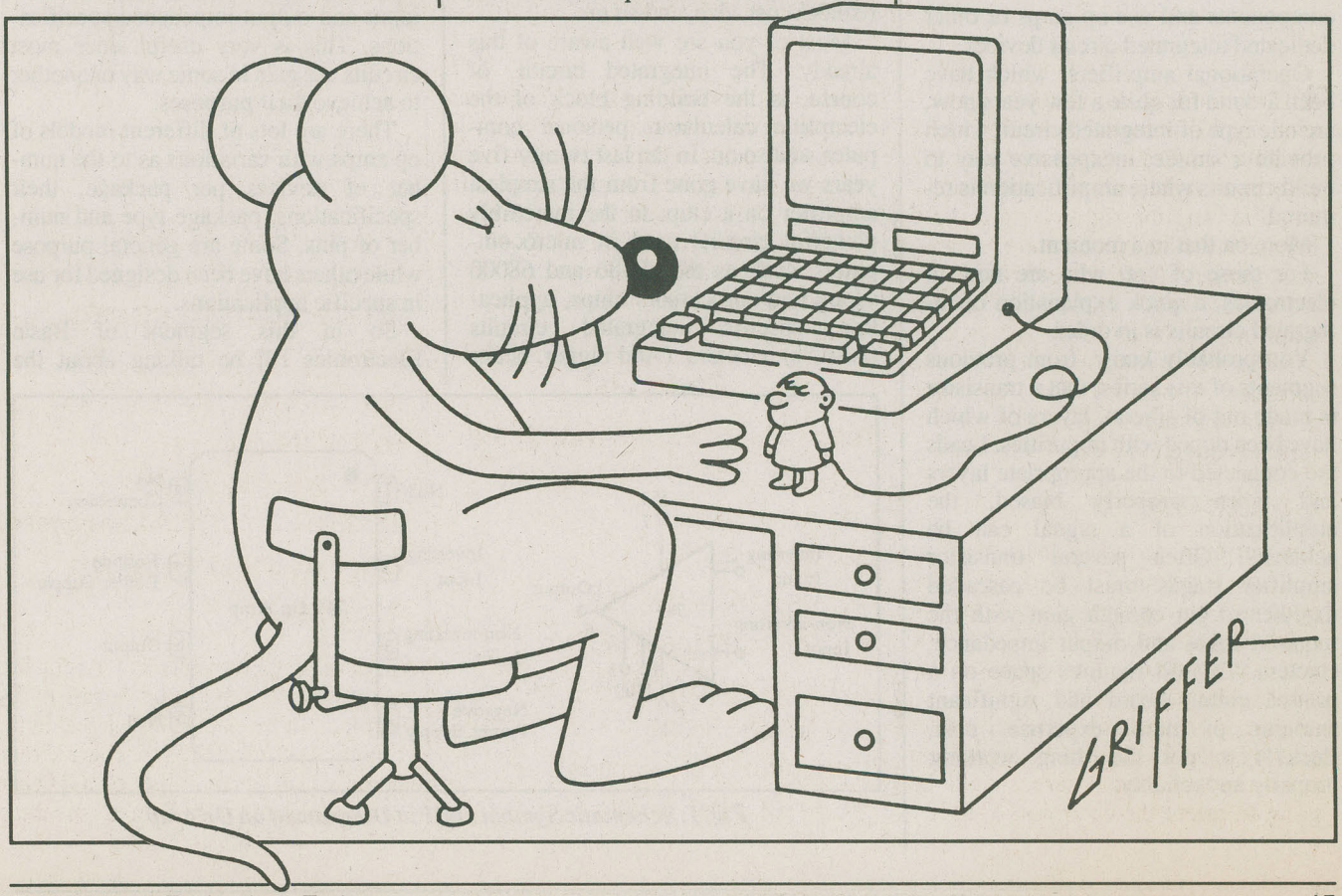


Fig. 4. Rear Channel Speaker Placement

If either L_{in} or R_{in} is grounded and a signal is fed to the other input, there should be a signal present at the output of IC1D and hence from the rear speakers. These initial tests should be conducted using a 1kHz sinewave for the test signal. Signals lower than 100 Hz will be amplified and can be adjusted using the bass control RP1. The gain of the rear channel can be adjusted with gain control RG. The frequency response of the rear channel should roll-off above 7kHz.

Installation

Two methods of installation are shown in figure 3. If you own a separate component system, the surround-sound decoder is placed in between the preamp and the power amplifier as shown in figure 3a. If you own a receiver, then the decoder is placed in a tape loop as shown in figure 3b. The placement of the rear speakers is important. They should be mounted at the rear of the side walls about six feet above the floor. This is shown in figure 4. If the speakers are mounted on the rear wall, they will not sound like ambient reflected sound. Proper placement is important for exciting three-dimensional sound in your listening room. ❐



Feature

Basic Electronics #5

by Ron C. Johnson

Here's a riddle for you: What area of electronics knowledge is most rapidly becoming obsolete? (Besides copies of Steve Rimmer's old editorials, I mean...)

Transistor design, of course.

Why?

Because, unless you are one of those individuals who likes to inflict pain on yourself, (hmm... in which case you possibly do read Steve's old stuff as well...), you will, whenever possible circumvent the whole issue of discrete components and use op amps or other dedicated integrated circuit devices.

Operational amplifiers, which have been around for quite a few years now, are one type of integrated circuit which provide a simple, inexpensive way to build circuits where amplification is required.

More on that in a moment.

For those of you who are new to electronics, a quick explanation of integrated circuits is in order.

You probably know, from previous segments of this series, that a transistor is made out of silicon, layers of which have been doped with impurities. Leads are connected to the appropriate layers and when properly biased, the amplification of a signal can be achieved. Often several transistor amplifier stages must be cascaded together to get enough gain with the required input and output impedance, etcetera. This all requires space on a printed circuit board and significant amounts of time, expertise, cost, (luck?!) to get the thing working properly and reliably.

Op Amps

Enter the integrated circuit. By using precision photographic techniques, whole circuits, including many resistors, transistors, capacitors, (made out of layers of doped silicon), can be deposited on tiny 'chips'. Fine wires are connected to appropriate spots on the chip and extend out to pins arranged around the perimeter of the device. Obviously, with a whole circuit on the chip, circuit design should be simplified while the complexity is increased. This reduces cost, size, and so on.

Most of you are well aware of this already. The integrated circuit, of course, is the building block of the electronic calculator, personal computer, and so on. In the last twenty-five years we have gone from the simplest amplifier on a chip, to the incredibly powerful circuits used in microcomputers, such as the 80486 and 68000 series microprocessors chips, application specific integrated circuits (ASIC's), etcetera. (And bigger, better models are arriving every day. So come on down to Honest Ron's used chip emporium today for low, low 4.9% financing... oops, sorry. I get carried away...)

Where was I?

Operational amplifiers. Yes... One type of integrated circuit is an operational amplifier. An op amp is a building block, an amplifier with certain known specifications, which can, with a minimum of external components, be used to obtain a given amount of gain over a given bandwidth with known input and output impedance specifications. This is very useful since most circuits use gain in some way or another to achieve their purposes.

There are lots of different models of op amps with variations as to the number of devices per package, their specifications, package type and number of pins. Some are general purpose while others have been designed for use in specific applications.

So in this segment of Basic Electronics I'll be talking about the

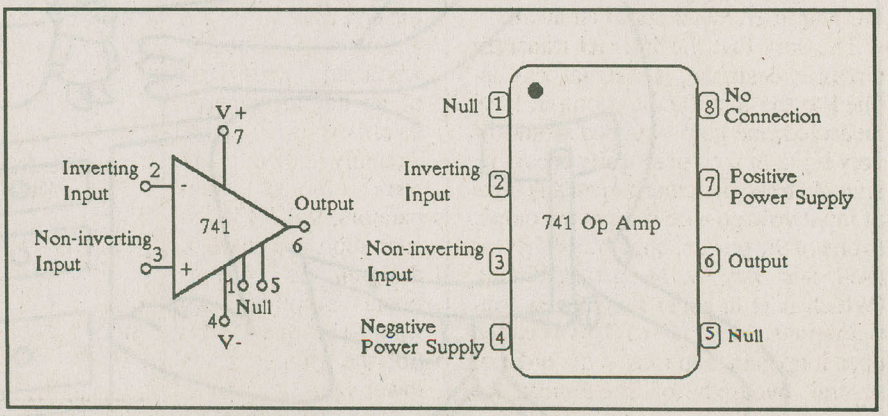


Fig. 1. Schematic Symbol and Pin Diagram of an Op Amp

theory of op amps and some applications they can be used in. As usual I'll try to keep it simple but there is a bit of math necessary so that you can design an op amp stage for yourself. Next month we'll build one or two of the actual circuits talked about here.

Here we go...

An op amp is a high gain DC amplifier that has a high input impedance and a low output impedance, as mentioned previously, built into a single device with several leads. Figure One shows the schematic symbol and pin diagram for a typical (if somewhat older), op amp, the 741 general purpose op amp. Figure 2A shows the internal circuitry. Of course, we can only access the input and output pins of the device so the internal schematic has limited usefulness to us.

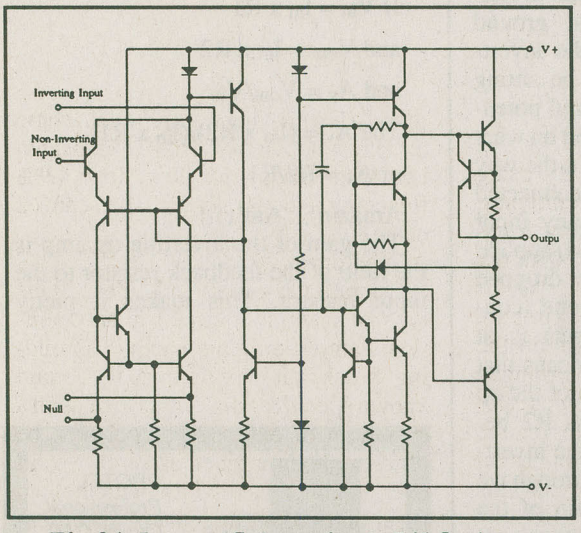


Fig. 2A. Internal Schematic of a 741 Op Amp

I said that an op amp is a high gain DC amplifier. What does that mean?

The way that the internal transistor circuit is designed, if a signal was applied to the input and the output level measured, the gain obtained would be very high. In fact, practically speaking, it would be so high that almost any level of input voltage would drive the output to one of the power supply rails if it was used this way in an actual circuit. (Which it is in some specialized configurations. More later.) This is called open loop gain, and runs in the order of several hundreds of thousands: for design purposes we can consider it to be infinite.

In addition to its high gain an op amp is a DC amplifier because the internal circuit is direct coupled (no capacitive coupling between stages). This means it will amplify from DC (zero cycles per second) and up. This is important because it enables the op amp not only to amplify AC signals such as audio or radio frequencies, but it can amplify DC levels, useful in applications such as comparators, servo controls, etcetera.

I also said that the op amp has a high input impedance and low output impedance. If you remember some of the considerations used when we designed a transistor amp a few segments ago you will know that a high input impedance is desirable; it means that the input of the amplifier does not load down the previous stage. Low output impedance is also desirable; it means that the amplifier can drive fairly low impedance loads efficiently.

All of these specifications make the op amp superior to designing with transistors. Again, looking back at our transistor amplifier, (which we ultimately used to build a phase shift oscillator), gain, input impedance and output impedance were important and interrelated considerations which made the design difficult. With the op amp we start with almost ideal conditions and design from there, sometimes compromising them in the process.

You're probably wondering what kind of an amplifier needs an almost infinite gain. Actually there are some, called comparators, which I'll discuss shortly, but when designing a conventional amplifier we want to be able to control the gain to some lower value.

How do we do it?

Feedback is the answer. Negative, that is. When we discussed oscillators we considered positive feedback which meant feeding the output back to the input in phase, or with zero phase shift, (a positive output is added to a positive input increasing the signal). If the gain was high enough oscillation occurred. Negative feedback means feeding back the output 180 degrees out of phase, (a negative output is added to a positive input decreasing the total which decreases the gain).

Op amps are purposely designed with inverting and non-inverting inputs to facilitate controlling the way signals are fed into them. This makes it easy to add a few external components to obtain a predictable amount of negative feedback and thus a predictable gain. Usually op amps a powered from a split power supply (positive and negative voltages with respect to ground) to facilitate the output fluctuating around zero volts. This is necessary to obtain a true AC waveform at the output.

Actually determining the resistor values and configuration needed for a desired gain requires a bit better understanding of how the device operates and its specifications. Let take a little deeper look...

As I mentioned, op amps have both inverting and non-inverting inputs, labelled negative (-) and positive (+) respectively. The non-inverting input causes the output to change proportional to the input by a factor of whatever

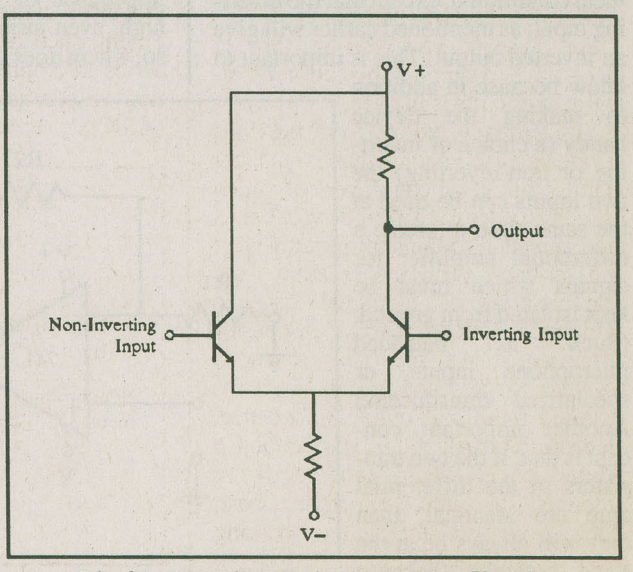


Fig. 2B. The Differential Amp Input Circuit

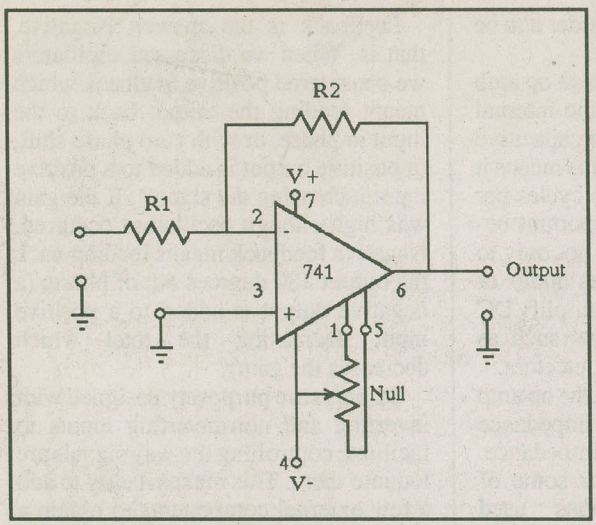


Fig. 3. An Inverting Op Amp Configuration

the gain of the circuit is. If the input goes positive, the output will go positive as well. The inverting input does the opposite. When the input goes positive the output will swing negative. This is the same as saying that a signal applied to the inverting input would be given a phase shift of 180 degrees through the amplifier. A signal applied to the non-inverting input would have a zero degree, or no shift at all, through the amplifier.

Figure 2B shows a simplified schematic of the input circuitry inside the chip. This is a typical differential transistor amplifier which provides the two inputs mentioned. Signals to either of the bases of the transistors will be amplified by the same amount (under ideal conditions), except that the inverting input, as mentioned earlier will give an inverted output. This is important to know because in addition to making the device handy (a choice of inverting or non-inverting) the two inputs can be used at the same time to create a differential amplifier for signals which must be kept isolated from ground. (Such as balanced microphone inputs, or specialized transducers.) Another important concept is that, if the two transistors in the differential amp are identical, then they will always be at the same potential, because their emitters are tied together and both bases will be 0.7 volts higher.

Well, how do we use these inputs to obtain what we want?

Figure 3 shows a typical inverting op amp configuration where negative feedback is applied using two resistors, R1 and R2. Notice that the non-inverting input has been tied to ground. If the non-inverting input is at ground potential then the inverting input must be sitting virtually at ground potential as well (based on what I said earlier about the way the internal transistors are connected together). That means that any input voltage (with respect to ground) applied to the resistor, R1, will be dropped across R1 because its other end (connected to the inverting input) is at ground potential. That also means that any voltage on the output pin of the op amp must be dropped across R2 because it also is connected to the inverting input. If we think that all through we can then believe that the gain of the amplifier, which is the voltage out divided by the voltage in, will be:

Gain (Av) = V_{R2}/V_{R1}

Are you still with me? Okay, here's where I pull a rabbit out of a hat...

Remember that I said that the input impedance of the op amp was very high, even infinite for our purposes. If so, where does the current go that flows through R1 creating the voltage across R1? The only other path it has is through the feedback resistor, R2. R1 and R2 are effectively in series if the input impedance is infinite. That means that the same amount of current flows through both resistors.

Stay with me here, folks... It isn't as bad as it looks. Remember that when the input voltage is going positive the output, being inverted, is going negative, so the current will flow as I have said. But what does this all mean?

If $V_{in} = I_{in} \times R1$

and $V_{out} = I_{in} \times R2$

and $A_v = V_{out}/V_{in}$

The $A_v = (I_{in} \times R2)/(I_{in} \times R1)$

or $A_v = R2/R1$

Amazin'... Ain't it!

The gain of the inverting op amp is the ratio of the feedback resistor to the input resistor. This makes it pretty

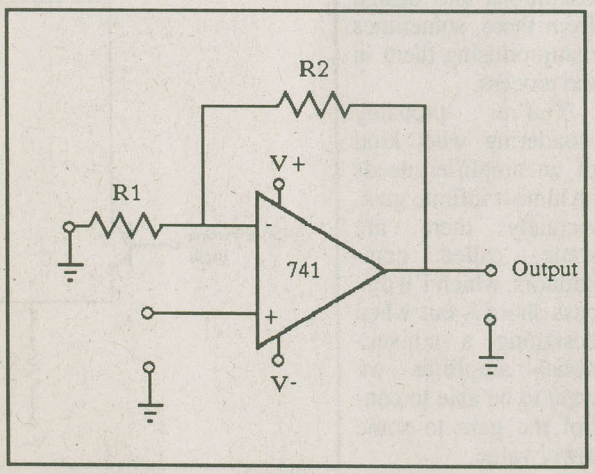


Fig. 3. A Non-Inverting Op Amp Configuration

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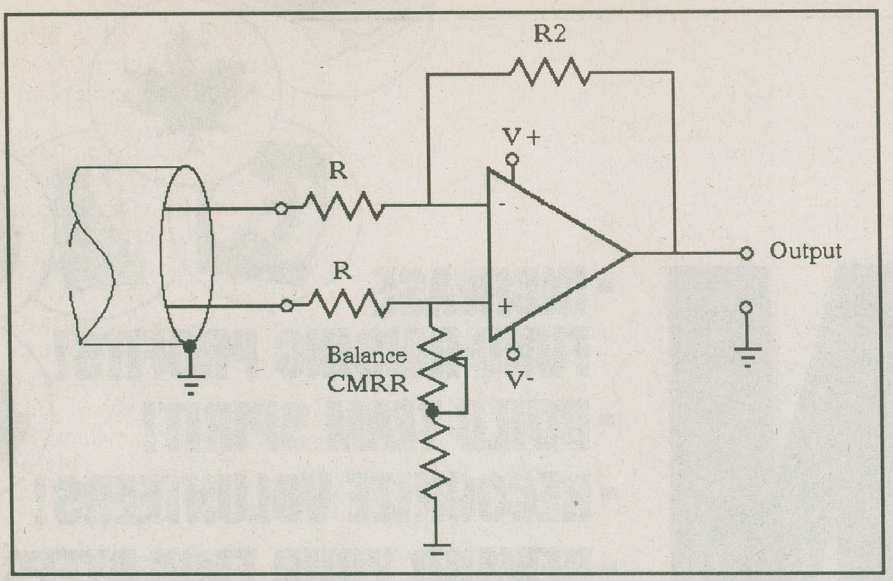

Fig. 4B. A Balanced Differential Amplifier

simple to design a gain stage which has good input impedance and output impedance with an op amp and two resistors.

Well, what if you want to build a non-inverting amplifier?

Figure 4A shows a variation on the previous circuit which allows you to put the input on the non-inverting input and ground the inverting input. The output will then be in phase with the input. I won't go through the derivation of the gain formula. Let me just tell you that the closed loop gain for the non-inverting amp is:

$A_v = (R2/R1) + 1$

I said before that both inputs could be used at the same time to create a differential amplifier for balanced microphone inputs, etcetera. Figure 4B shows a typical configuration of this sort. This has a definite advantage in that the usual balancing transformer can be eliminated and improve performance at the same time. This is due to the Common Mode Rejection provided by the differential input. Because the inputs drive the output in opposite directions, any signal that is present on both inputs will be cancelled out, one input causing the output to go one way while the other causes it to go the other. The Common Mode Rejection Ratio is a specification of the device which indicates how well it accomplishes this. In the circuit shown the CMRR is further enhanced by including a potentiometer to adjust for best CMR performance.

What's next?

Voltage followers.

A voltage follower is a non-inverting configuration in which the output is coupled back to the inverting input directly and the input signal is connected directly to the non-inverting input. If you look at the gain formula for a non-inverting amplifier and plug in zero ohms for both R1 and R2 you will find the answer is a value of one. The gain of a voltage follower is one; but what good is that? (And why do they call it a voltage follower anyway?)

The answer is in the input and output impedances. Sometimes we don't need any voltage gain through a stage but we need to match impedances. We need a high input impedances so as not to load down the previous stage and a low output impedance in order to drive the load with sufficient current. The voltage follower does that for us. (And I don't know why they call it a voltage follower... Actually, not entirely true. Usually this stage follows a stage of voltage gain to achieve the purposes I just mentioned.)

Onward!

Comparators

Actually comparators are a device unto themselves but are really just op amps with specs and features particularly suited to switching applications. Regular op amps can be used as comparators in most applications too. A comparator is a device which compares the levels of the signals on its inputs and switches its output depending on which is at a higher level. As shown in Figure 6 a comparator configuration uses no feedback which means that the gain of the circuit is very high. If the voltage on the non-inverting input is more positive than the voltage on the inverting input the op amp amplifies the differential voltage by this large gain causing the output to quickly reach the positive power supply rail. If the signal level on the inverting input is larger, the opposite happens, sending the output to the negative power supply rail. All this amounts to a switching action depending on the input levels.

In the circuit shown in Figure 6 the non-inverting input has a sine wave applied to it while a reference voltage is connected to the inverting input. The waveforms show that as long as the sine wave is below the reference level the output of the op amp is sitting at the negative power supply. When the instantaneous value of the sine wave exceeds the reference voltage the op amp output switches to a level equal to the positive power supply.

Figure 6 also shows how a reference voltage would be practically obtained, using a voltage divider consisting of two resistors in series.

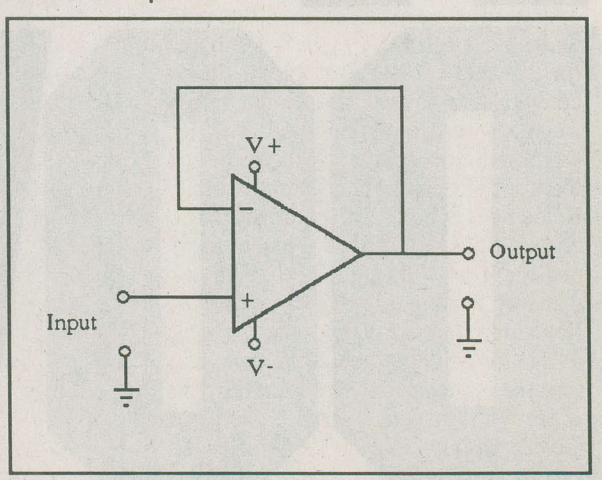

Fig. 5. A Voltage Follower Configuration

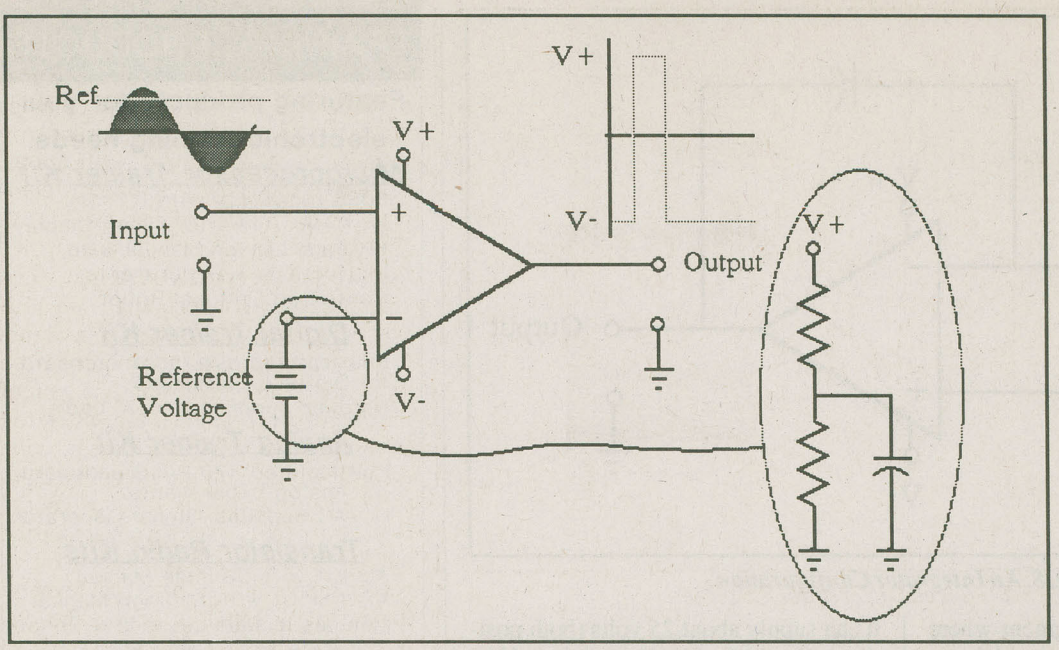

Fig. 6. A Comparitor Configuration

Next, we look at the summing amp in Figure 7. This is really just an inverting amplifier with additional inputs but is a useful configuration for many applications. By tying several resistors together at the inverting input several signals can be mixed together (like in an audio mixer or some instrumentation applications). The gain associated with each input is determined as before and, by choosing the value of the input resistor the gain associated with each input can be made different.

The integrator shown in Figure 8 is an interesting and useful, if somewhat specialized, circuit. If you remember your high school calculus you will know that integration is a mathematical operation which determines the area under a curve (or any other waveshape, for that matter). An example of this is converting a square wave input into a triangle wave at the output. The integrator uses a capacitor in the feedback loop of the op amp to accomplish this. Remember when I said that the same current that flows through the input resistor flows through the feedback resistor? In this case that same current flows into the feedback capacitor, and, if the input voltage is held constant, then the input current is constant. If you were with me 'way back when we talked about capacitors in Basic Electricity you will remember that the voltage across a capacitor will increase linearly if the current into it is kept constant. In this case the capacitor will charge at a constant rate which amounts to the same thing as integrating the signal applied to the input. We know that the voltage across the capacitor is the voltage at the output because the op amp input is at virtual ground.

Scary ain't it?

Okay... and finally, Figure 9 and the Wien Bridge Oscillator. I don't have to go into how an oscillator oscillates. You already know from reading the segment on transistor oscillators. (And if you didn't, just ask E&TT for a back issue. They'd be glad to help.) But here's a clue anyway: Gain of One and Positive Feedback.

The Wien Bridge Oscillator makes use of both of the op amp's inputs to accomplish this with both positive and negative feedback. The positive feedback loop couples the output of the op amp back to the non-inverting input through a bandpass filter using two resistors and two capacitors. This allows a narrow band of frequencies to be coupled, in phase, to the input of the amp but in so doing, that band is attenuated by about a factor of 1/3. To make this up the amp must have a gain of about three so the negative feedback to the inverting input is set to obtain that gain. All of this fulfils the requirements for oscillation.

Wow, what a list. And, of course this is not really complete. There are endless variations on the configurations I have shown you here, and a few more that I didn't have room for.

The problem with all of this is that it sounds good on paper. What about the practical end of op amps? Are they really as easy to work with as I have suggested? Actually, they are, as you will

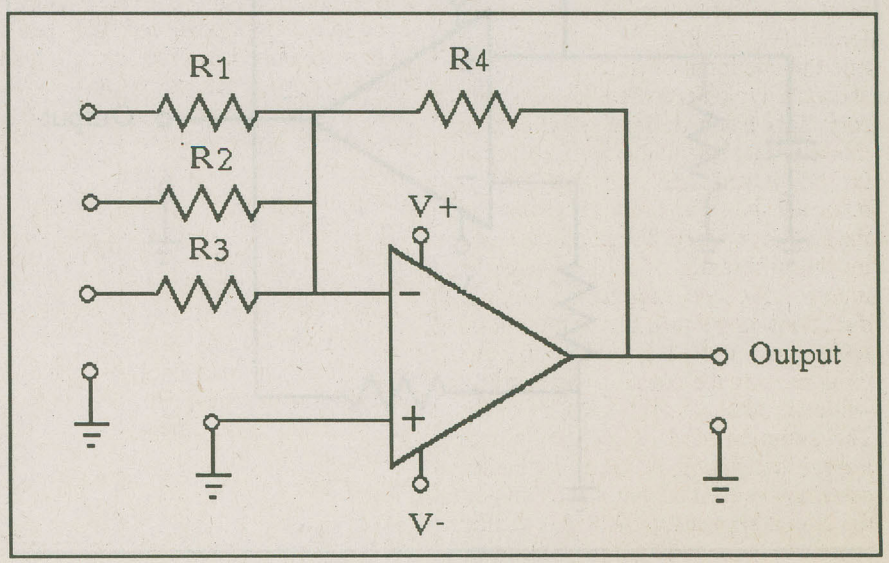

Fig. 7. A Summing Amplifier Configuration

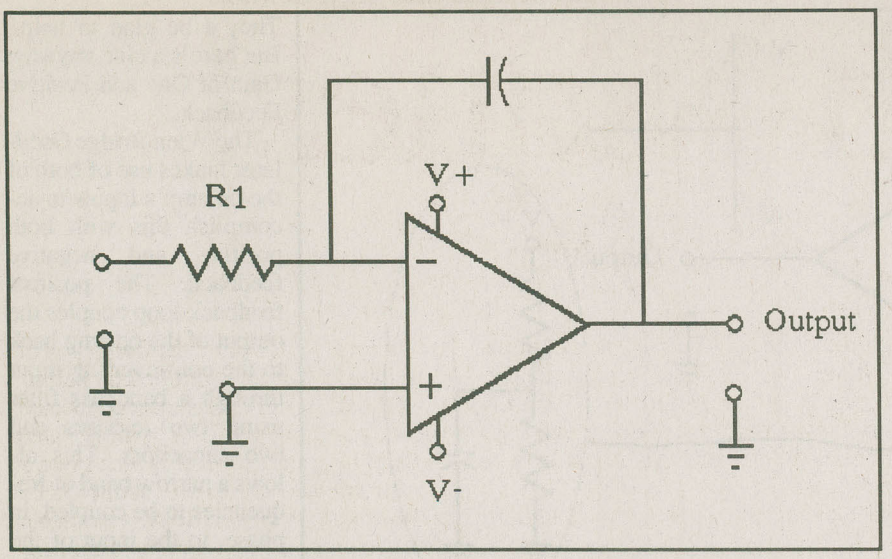

Fig. 8. An Integrator Configuration

see from next month's segment where I'll have a small project in which we throw a few of these circuits together on a breadboard and from there onto a printed circuit board. One thing you will need in order to breadboard and test op amp circuits is a dual power supply so if you were thinking of building or buying a DC power supply, make sure it can supply about 25 volts (both positive and negative) and at least a half an amp.

Must sign off for this month. Gotta get back to reading Steve's old editorials. See you next time... ❐

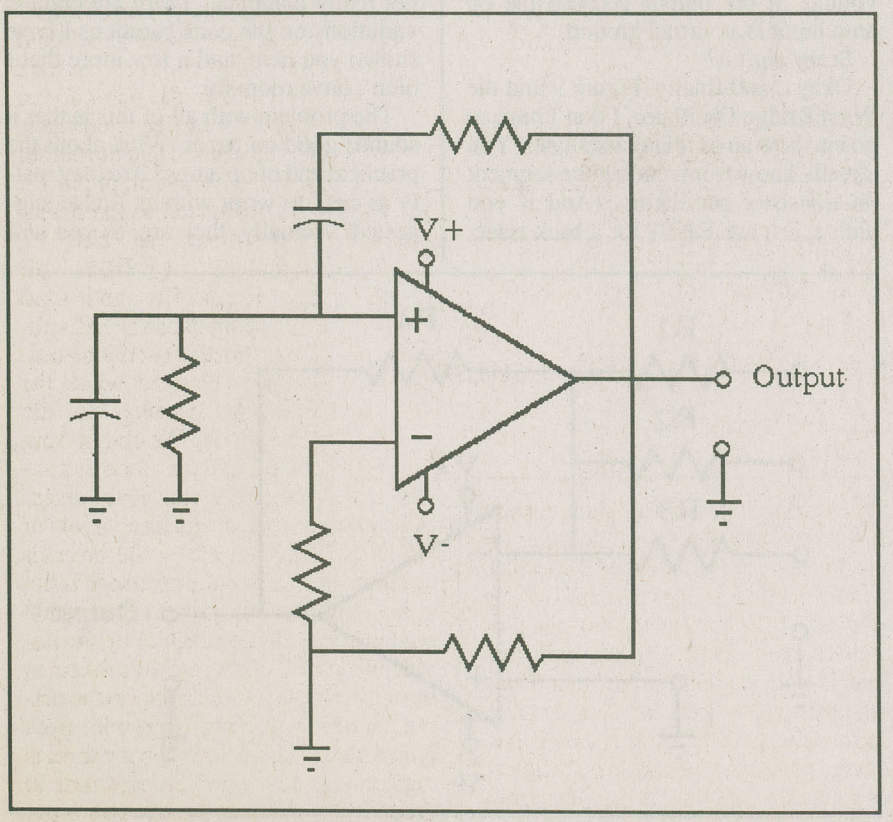

Fig. 9. A Wien Bridge Oscillator

Tech-Niques!

by Ron C. Johnson

Here's an interesting integrated circuit that I found in a small control board out of a commercial coffee maker (from my days of fixing almost anything under the sun): the LM1830 Fluid Detector chip. The application it was used for in the coffee maker was a high water level detector. Starting the fill cycle was initiated manually by the person who put in the fresh coffee grounds, etcetera, but the level detector was used to shut off a solenoid valve when the water in the urn reached the correct level. Sensing a water level using a conductivity type probe is not difficult and could be done easily without a specialized chip, but this one is convenient to use and has a couple of features which make it attractive for this, and other, applications.

Figure 1 shows a diagram of the internal function blocks of the chip. As you can see, within the fourteen pin dip package there is an oscillator, a detector input, an output amp and driver, and provisions for connecting three capacitors and a resistor.

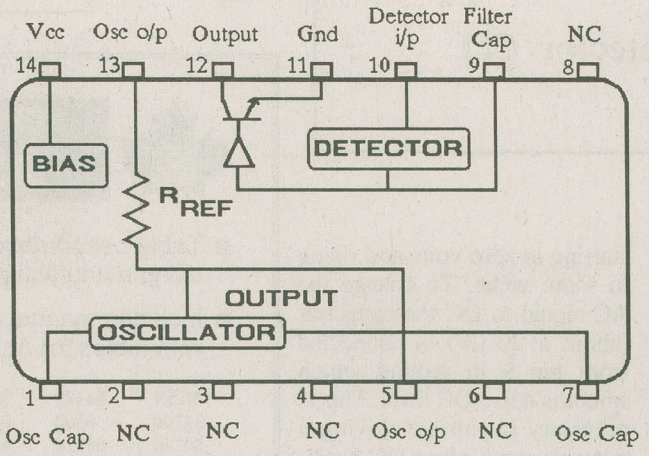

Figure 1. LM1830 Liquid Detector Chip

In principle, this chip uses a conductive probe as an electrode and the metal container as ground (or two electrodes if the container is not metal), and allows current to flow through the liquid when it reaches a high enough level to complete the circuit between them. It's important to remember that liquids only conduct electricity if they are polar in nature — that is, if they contain mobile ions in solution. An example of this is water with table salt, (NaCl, sodium chloride) dissolved in it. The salt disassociates into Na+ and Cl- ions and becomes a good conductor. Typically drinking water has a high enough level of various elements dissolved in it to conduct electricity quite well. (So don't use your electric shaver in the bathtub!)

As I said, when the water covers the probes it allows current to flow, which we can detect and use as an indication of high level. But why does this chip have an oscillator in it? The answer comes from the fact that when current flows from one electrode to the other (in one direction only, as with DC current), the ions, which enable current flow in a solution, are deposited on the anode, or positive electrode, causing a build up. This is called electroplating, and has lots of uses, but not in this application. To keep this from happening we use AC voltage across the electrodes. The alternating action stops electroplating from happening.

In the LM1830 chip the frequency of oscillation can be controlled by selecting the value of the capacitor connected from pin 1 to pin 7. A typical value would be about 0.001 uF which gives a frequency of oscillation of about 6 kHz. The output of the oscillator is available on two pins of the IC. For most applications using water the output on pin 13 would be used, as the chip is equipped with an internal resistor to adjust the sensitivity for water. If another liquid (which has a greatly different conductivity) is being sensed, pin 5 is a direct connection, bypassing the internal resistance. A resistance value can be calculated taking the new conductivity into account.

Figure 2 shows a liquid level control circuit similar to the one I found in the coffee machines. You can see that the output of the oscillator, at pin 13, is connected to the detector input, at pin 10, through a 0.05 µF capacitor. The cap is used to ensure that any DC voltage on the oscillator output is blocked while the AC is coupled to the electrode. The output from the oscillator, then, is connected to the level detection electrode, the voltage level of which is being sensed by the detector circuitry. As long as the electrode is not being "shorted" to ground (the metal container or other electrode) by the liquid, the oscillator signal is connected through the detector circuitry to the output transistor, turning it on with each pulse of the oscillator. When the level is high enough to "short" the electrode to ground, the signal at the detector input decreases significantly and the transis-

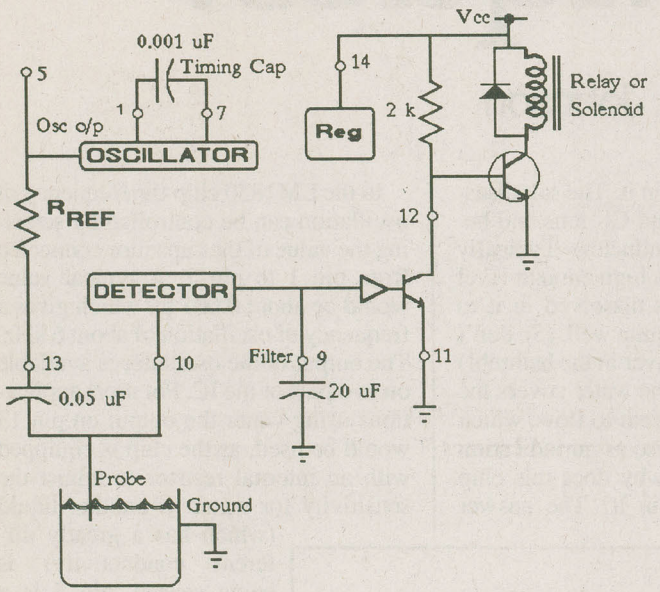

Figure 2. Level Detector Cct

tor is no longer turned on. This constitutes an "active" low level indication, because the transistor is on when the level is below the electrode, but this can easily be inverted using another transistor (as shown in Figure 2) or by choosing the appropriate contact in the relay driven by the output.

There is one more capacitor, connected to pin 9, which is used when the output of the chip is driving a load which requires DC. This is required because the output of the oscillator, which we said was AC, is coupled to the input of the detector (pin 10) and from there drives the output transistor. The output from the transistor, then, will be the same AC signal (roughly a square wave at 6 kHz). At the output of the detector the AC signal is really a pulse waveform, each pulse starting at zero volts and rising to some value. To change the AC signal to DC the capacitor (about a 20 µF) is connected from pin 9 to ground which smooths it to a DC level. This is necessary if you are driving a relay or some other DC sensitive load. If you were driving an LED the capacitor would not be required.

This little circuit could be useful in a variety of applications: a sump pump controller, a humidifier water level controller, or an automotive windshield washer alarm. The chip operates from a single supply up to 28 volts and it can sink up to 20 mA of current. It operates with very few external components and the chip itself costs less that five dollars.

Keep those ideas and suggestions coming... ❐

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FEATURE

CANON'S BUBBLE JET PRINTING TECHNOLOGY

Revolutionary New Technology Changes the Way We Print

by Stan Skorayko,
Sales Director, Canon Canada Inc.

One of the most exciting printing technologies to be introduced in recent years is that of Canon's Bubble Jet printers. This advanced form of ink jet technology, developed and patented by Canon, seems likely to emerge as the mainstream replacement for dot matrix printing systems.

The principle of Bubble Jet technology was discovered during the 1970's by a researcher in Canon's laboratories. Accidentally touching the hot tip of his soldering iron to the needle of an ink-filled syringe, he was intrigued to note that a jet of ink spurted out. Since that time, Canon has developed Bubble Jet technology into a much more controllable, refined printing system while maintaining the basic simplicity of the principle.

The technology used in Bubble Jet printers begins with a print head containing 64 individual print nozzles, each thinner than a human hair. When a microscopic heating element contained within every nozzle is activated, the heat creates a vapour bubble that propels intensely black ink onto the page where it dries instantly. As the bubble then cools, and contracts, a vacuum is created to pull more ink into the nozzle and the process repeats itself. Bubble generation is so fast that thousands of bubbles can be generated every second. To prevent ink clogging, the ink nozzles are automatically cleaned and the ends are capped when not in use.

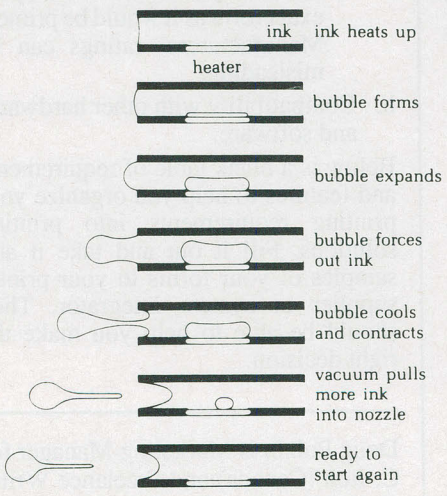
The Bubble Jet print head has no moving parts to make noise or wear out and the result is a fast, quiet, high quality printing system that is affordable, reliable and virtually maintenance free. In fact, comparisons with other printing systems highlight the real benefits of Bubble Jet technology.

Bubble Jet printers offer the affordability, durability and easy operation of dot matrix printers with much higher print quality (360 dpi resolution) and much less noise — in fact, they operate at a virtually inaudible 45 dBA noise level.

Comparisons between Canon Bubble Jets and conventional ink jet technologies reveal other advantages. The mechanical simplicity and low maintenance of Bubble Jet systems is in direct contrast to the complex, multi-component vibrating structure of a piezoelectric ink jet print head. Piezoelectric print heads can weigh ten times as much as Bubble Jets and as a result tend to be slower. In addition, the special ink formulation and Bubble Jet delivery system virtually eliminate smudging and result in higher quality images than with comparable ink jets.

Canon's Bubble Jet printing technology has a wide variety of applications. Currently it is found in stand-alone machines such as portable and desktop computer printers, as well as personal wordprocessors, printing calculators, and full colour copiers. In the near future, however, as Bubble Jet technology progresses, products will be linked directly with designers' workstations to act as output devices for complex computer graphics. Here again, speed, high image quality, plus the ability to handle image processing in real time will make Bubble Jet products a formidable force. ❐

How bubble jet works



FEATURE

PATH TO FORM PRINTING HEAVEN

By Doug Polzin, C. Itoh (Canada)

Labels, multi-part forms, tow tickets, membership cards, registration cards, invoices, purchase orders, picking slips, the list goes on and on. All of the above present their own problems when it comes to printing. Each of them require careful examination before finding the right printer solution. Can you get by on your existing printer or will you need another (possibly dedicated).

The Secret(s) to Forms Printing Success

I. Good forms design is essential.

Most people who work in the forms manufacturing or computer industries have seen any number of forms horror stories. Companies have spent thousands of dollars on expensive forms only to find out too late that no printer could run them or that they would now have to spend many more thousands for a printer that could. Good forms design should always take into consideration the computer printer they will be expected to work with.

Important forms design and construction features that will affect paper handling*

1. Thickness - each page (including carbons and inserts) as well as the total. How many parts a printer can handle depends to a large degree on the thickness of each part including carbons, fastenings and inserts.
2. Width and length of the form - Printers are limited in what paper size and printable area they can handle.
3 Stiffness of the material - The more curves the form has to make the more problems a stiff material can cause.
4. The type of material - paper, plastics, stock, etc. Is it going to be strong enough, will ink adhere properly, etc.?
5. Location and size of windows, inserts, cards, etc. - Variations in thickness across the form can actually cause damage to the print head.
6. The size, location and type of perforations and fastenings - There are basically two types of fastenings, "Crimping" and "Gluing". Crimping can effectively double the thickness of the form at that location. Even gluing will increase overall form thickness.

The bottom line is, deal with an experienced forms designer/consultant and avoid embarrassing and costly mistakes.

II. Try before you buy.

An experienced forms manufacturer will qualify their clients' needs not just in content of the form but as to how it will actually be printed.

If there is any doubt (and there usually is) I recommend trying out a similar form on the printer that you will be using (Tim McGinnis, a professional forms consultant recommends running 150 feet of forms through the printer).

Be aware that even small changes in the design and construction could have negative effects on the form handling. Most printer suppliers will be happy to provide a demonstration on the computer printer they are recommending.

If the forms manufacturer/designer doesn't have a similar form, are you sure you want to be the guinea pig for this possibly expensive experiment?

When testing, don't just consider how the last copy looks but how well the forms move through the system. Is there any bunching up, tearing or smudging. Does the printer seem to be working harder than it should, etc. etc.?

Other considerations regarding forms handling are:

1. The age of the forms (how long have they been on the shelf). Tim McGinnis recommends 9 months as an average stock life.
2. The length of the print run. The longer the run the more likely problems will occur.
3. The position of the input paper stack in relation to the printers input slot. Having the paper wind around cables or equipment before it goes into the printer is sure to cause problems. A straight entry path is always the best.

* The details regarding forms design and construction where developed with assistance from Tim McGinnis of Future Forms & Systems of Brampton.

III. Matching printers to the forms required.

Dedicated or Multi-purpose?

No printer can be all things to all applications. If you want to avoid printing problems think ahead about the various jobs you'll be asking your printer to do and note the features that are going to be important. Maybe you do need more than one printer.

What to look for in Forms printers

a. Print head clearance across the platen.
b. The straightest paper path possible.
   - Bottom feed
   - Straight through
c. Push and/or pull tractor feed availability and position.

   The more the better control.
d. Copy capability (in pages and inches). - is it with or without carbon?
e. Reliability (MTBF and Duty Cycle) and Warranty. - can it take the doing the volume of work you expect.
f Ease of use.
   - How easy is it to load or change forms.
g. Speed.
   - - is it fast enough to do the job in the time you need it. Test your exact form as it would be printed. Manufacturers' ratings can be misleading.
h. Compatibility with other hardware and software.

Below is a blank table of requirements and features to help you organize your printing requirements into printing solutions. Fill it out and take it and samples of your forms to your printer supplier or system integrator. They should be able to help you make the right decision.

Doug Polzin is Marketing Manager for C. Itoh (Canada) and Freelance Writer for the Canadian Computer industry. ❐

FEATURE

AN OVERVIEW OF OFFICE AUTOMATION

by Steve Rimmer

A few years ago, a business microcomputer was an all but isolated entity, much as a FAX machine or a photocopier might have been. Something of a dedicated appliance back then, a computer was usually installed to do fiscal predictions or to create letters, and nothing else.

It has really only been in the past year or so that the real potential of microcomputers has started to make itself felt in business applications. Rather than merely being a box that produces letters or handles a mailing list, a computer can be the hub of your office. It can drive all sorts of diverse peripherals, and perform functions which might well be taking you a lot of man-hours to perform by hand at the moment — or which might be currently out of reach entirely.

The only commonly used piece of office hardware which a computer can't productively be interfaced to is a coffee maker.

The Power of Connectivity

It's worth looking at your office the way a computer might, that is, as data coming in, data being processed and data going out. Most office environments can be described by this model. In looking at what a computer can do for you, you should consider what elements of this model can be replaced by digital equivalents.

Let's consider a few simple microcomputer applications.

Computer based FAX has been available for quite a while, although it has really only become workable in the past year or two. There were, regrettably, a lot of very badly designed early FAX systems. Current computer FAX systems will allow you to do things with FAX you'd never have thought possible.

Information on a Disk

Information is all but useless if it's in a form which is too cumbersome to work with. Knowing that the answer to your question is in a particular book may be of little use if it turns out that someone has torn out the index.

Computers make searching for information a lot easier than traditional paper methods ever were, but only if you can obtain the information in a form your computer can work with.

Large bodies of information — such as vertical market databases — defy even the capacious storage capacities of hard drives to hold them. However, a surprising number of specialized databases are available in machine-readable form on CD-ROMs. A CD-ROm is essentially a compact disc, save that the information stored on it is actually computer data, rather than digitized sound. It's worth noting that CD-ROM can store both sound and digital information on the same disc, and most contemporary CD-ROM players will also play music from a conventional audio CD.

As with many emerging technologies, there were quite a few incompatible standards in CD-ROM technology a few years ago. They've all settled on a common format now, this being the Microsoft CD-ROM specification. Numerous hardware manufacturers produce CD-ROM drives which are compatible with this standard. The one I use is made by Sony. CD-ROM drives are available either as external, stand alone boxes or in a size which makes them suitable for installation in a floppy drive bay.

It's worth noting that the reason why CD-ROMs are so easy to use and so standardized is that a CD-ROM looks like a disk drive to your computer. Mine is drive G. Aside from not being able to write to it, I can access whatever disc I have in it as if it were a conventional hard drive.

Limited Edition Prints

The current technology in high end printing may offer you facilities you hadn't thought about. A laser printer will generate typewriter quality letters and typeset documents, for example, but it will also produce things like overhead transparencies and self-adhesive labels which look professionally printed and cost next to nothing. A mid-range laser is very, very fast compared to a dot-matrix printer, and worlds quicker than waiting for a commercial printer to get around to your work.

Colour printers offer some of the most interesting applications for printing, as they let you create documents which are genuinely eye-catching. A colour PostScript printer, such as the QMS ColorScript machines, will generate colour proofs and mockups quickly and relatively cheaply. While this facility has enormous application in graphic arts, it's also something well worth looking at if you need overhead transparencies or simple printed reports which look professional and really put that last ounce of power into your words and ideas.

If you use thirty-five millimeter slides in your presentations, you might want to look at a slightly different sort of hard copy device. Film recorders will go directly from computer output to slides with first class quality. Most high end film recorders cost several tens of thousands of dollars, and are out of the reach of casual users. However, systems such as Polaroid's *Palette* offer film recorder quality for about the price of a good laser printer. The palette will generate full colour slides of anything which you can display on a conventional PC screen. Coupled with Polaroid's instant slide film technology, you can create a whole presentation's worth of slides in half an hour, and have them processed and mounted ten minutes later.

While in a sense the opposite technology, scanners are intimately tied to printers in many applications. Sophisticated flat-bed scanners, such as the Hewlett-Packard ScanJet and Epson 300 series systems, have brought professional quality scanning down to manageable prices in the past few years.

The obvious application for a scanner is to digitize photographs, plans and other hard copy art. However, the technology which has really seen scanning come of age has been in the area of text. Optical character recognition systems such as *ReadRight*, from OCR Systems, will allow you to scan a document and wind up with a text file, ready to be inhaled and edited by your word processor. Contemporary optical character recognition software will read proportionally spaced text — such as what you're reading now — and can deal with multiple typefaces and type sizes. Typically almost completely error free, they can reliably turn printed documents into text files, even if they're badly printed or weirdly laid out.. ❐

Epson Changes the Face

Of Dot Matrix Printing.

ESC/P 2™ EPSON SCALABLE FONTS • ENHANCED GRAPHICS

The company that set the standard in dot matrix printing, has just raised it. Introducing Epson® ESC/P 2™, a breakthrough printer control system that, for the first time, brings scalable fonts to dot matrix printing.

Now, with ESC/P 2, you can do things with dot matrix printers that could only be done with lasers. Type sizes are no longer limited. Text and graphics are sharper and more accurate. Moreover, ESC/P 2 runs with all MS-DOS® computers, and is backwards compatible with virtually every major software application.

ESC/P 2 is now standard in four new Epson dot matrix printers — the LQ-570, LQ-870 and LQ-1170, as well as the AP-5000 from the Epson ActionPrinter Line. Each comes with a free diskette containing drivers for Microsoft® Windows,® Microsoft Word, WordPerfect,® WordStar® and more.

It's just what you need to take your printing to new heights.

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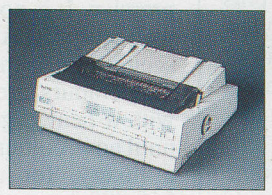
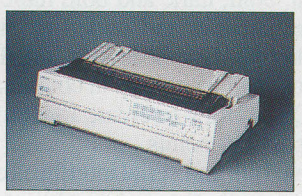
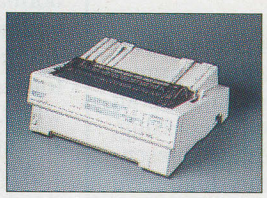


LQ-570



LQ-1170



LQ-870

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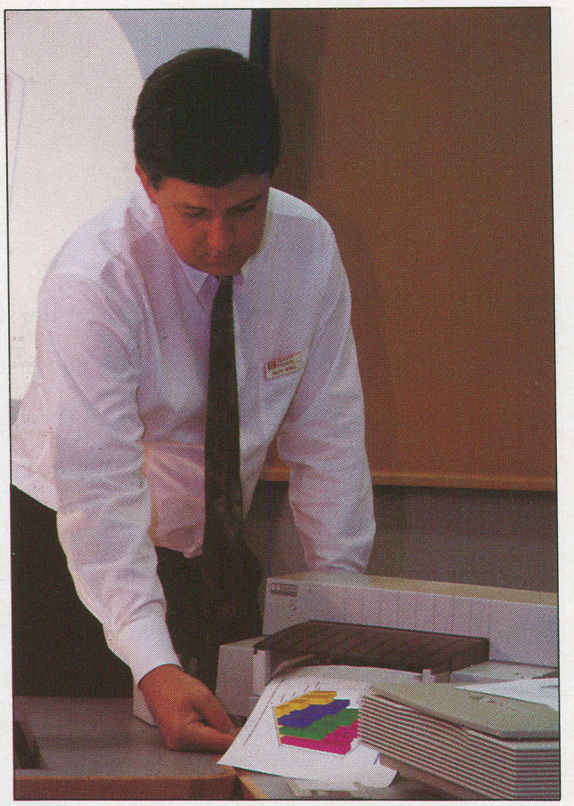
Review

HP INTRODUCES HP DESKWRITER C PRINTER

New Printer Delivers Laser-Quality Colour or Monochrome for Macintosh Computers

CN! Staff



The HP DeskWriter C printer is designed as an economical, laser-quality monochrome printer that also offers colour output. At $1,353 (Cdn. list) this is an excellent chance to obtain a quality printer and colour printing capability at the same time!

Colour Capability

The HP DeskWriter C printer produces black or colour output with 300 dots-per-inch resolution. To change from monochrome to colour, you simply swap the black ink print cartridge with a new tri-chamber, colour ink print cartridge. The colour print cartridge holds cyan, magenta and yellow inks that are mixed to create virtually any colour, shade or hue.

The HP DeskWriter C printer prints a monochrome page in approximately 20 seconds and a colour page in about 4 minutes.

It works with letter-size and legal-size plain paper, coated paper, transparencies, labels and envelopes.

A special container is included with the printer for convenient storage of print cartridges not in use.

New Driver

A new QuickDraw-based printer driver for the HP DeskWriter C printer enables one to take advantage of all popular Macintosh word-processing, business-graphics, spreadsheet, presentation and other programs that have monochrome as well as colour output options. The new driver offers: one-step matching between colours on the computer monitor and the printer output, eliminating the need for trial-and-error adjustments, a choice of dithering patterns from simple to complex that produce various textures in the printed output and a built-in spooler that batches print requests, allowing users to continue working with their computers as documents are printed.

Laser Quality Black Output

The HP DeskWriter C printer is the first monochrome HP inkjet printer to offer grayscale black output. Grayscaling creates high-quality graphics and photographic-looking images.

The printer features the four internal scalable typefaces included in the original HP DeskWriter printer: Helvetica, Times, Symbol and Courier. Seven other scalable typefaces also are available in the HP DeskWriter Font Collection. The collection is $240 (Cdn. list) and includes Palacio, New Century Schoolbook, Bookman, Avant Garde, Zaph Chancery and Zaph Dingbats.

Most of the typefaces are available in normal, bold, italic and bold italic plus outline, shadow and underline styles. All internal typefaces use Intellifont font-scaling technology in combination with QuickDraw to create fonts in any size up to 250 points.

AppleTalk and serial interfaces come standard with the HP DeskWriter C printer.

HP's Inkjet Technology

HP DeskWriter printers use HP-developed inkjet technology that creates text and graphics by laying fine ink droplets on the page.

Beautiful Colour

The colour output of this printer is impressive. It is not fast — but the wait is well worth it. Also, the grade of paper seems to influence the colour intensity. The colours are much more brilliant with a heavy, good-quality paper. Up until now, colour output was considered a luxury, for those with $5,000 or $10,000 to spend. Now, for the first time, colour is affordable.

For more information contact: Inquiries Manager, Hewlett Packard (Canada) Ltd., 3289 Lenworth Drive, Unit B, Mississauga, Ontario L4X 2H1, Tel: 1-800-387-3867. ❐

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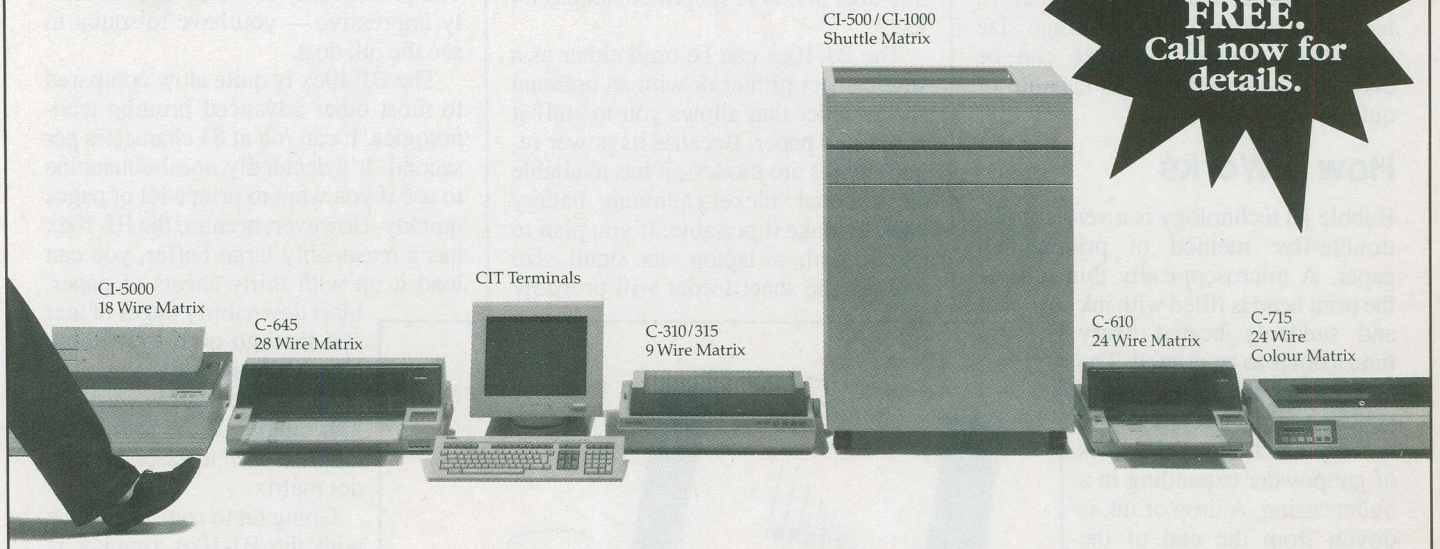

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CANON BJ-10ex BUBBLE JET PRINTER

Revolutionary New Technology Changes the Way We Print

by E&TT Staff

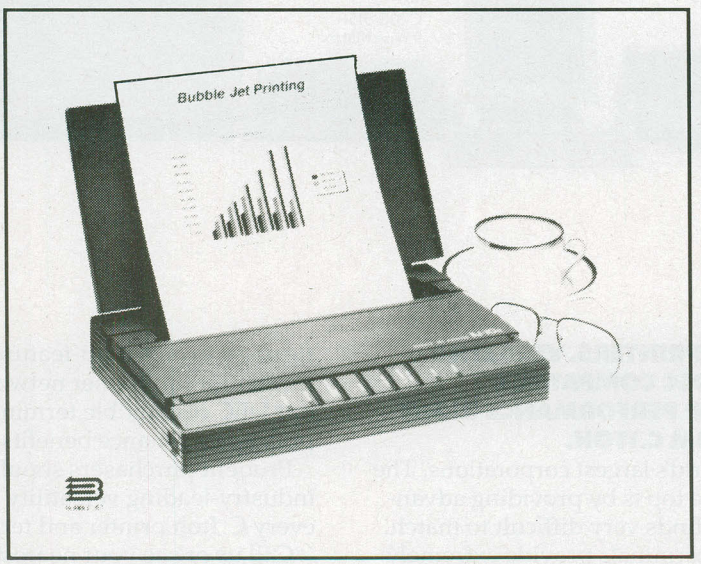
The first thing you notice about The Canon BJ-10ex bubble jet printer is that it's really small! In fact, it's smaller than an average size dot matrix printer. But size can be deceiving — this printer is capable of quite a bit!

How It Works

Bubble jet technology is a very simple, trouble-free method of printing on paper. A microscopically thin tube in the print head is filled with ink and suddenly heated every time a dot is to be printed. The heat causes the liquid ink to vaporize almost explosively — very much along the lines of gunpowder expanding in a bullet casing. A drop of ink is driven from the end of the tube and propelled toward the paper. Unlike in an ink-jet printer, which propels its drops of ink by electrically charging them, the ink that reaches the paper doesn't have a lot of water left in it; a bubble jet printer therefore emits largely dry pages. Ink jet printers, by comparison, can often leave you with pretty soggy sheets if you print high-density graphics.

Another important aspect of bubble jet technology is that each actual jet is very simple, and hence can be made very small. A bubble jet print head can have a very high density of jets, resulting in superb type quality. Indeed, the Canon BJ-10ex has print that is so tight as to surpass that of a laser. It can print 360 dots per inch. Its print head has 64 jets.

The BJ-10ex can be used either as a single-sheet printer or with an optional sheet feeder that allows you to stuff it with bond paper. Because its power requirements are modest, it has available an optional nickel-cadmium battery pack to make it portable. If you plan to use it with a laptop, its small size without the sheet feeder will probably be extremely attractive.



The BJ-10ex uses a standard Centronics-style parallel interface and can be driven by most software. It features emulations of the IBM Proprinter and Epson FX-80 printers.

Print Quality

The print quality of the BJ-10ex is really impressive — you have to squint to see the ink dots.

The BJ-10ex is quite slow compared to most other advanced printing technologies. It can run at 83 characters per second. It's decidedly not the machine to use if you want to print a lot of pages quickly. However, because the BJ-10ex has a reasonably large buffer, you can load it up with thirty sheets of paper, blast down thirty pages of text and then go on to something else while it prints your letters. But the wait is worth it. The quality of the printing is much closer to laser than to dot matrix.

Going on to something else with the BJ-10ex running is fairly painless. It's not completely silent — you can still hear the paper transport moving — but you'd have to be pretty easily distracted for the little noise it makes to bother you.

The bubble jet technology of the BJ-10ex is exceedingly impressive. The graphics emulation modes worked very well, producing truly square pixels and the text mode gave superb quality print.

For more information contact: Canon Canada Inc., 6390 Dixie Rd., Mississauga, Ontario L5T 1P7, Tel: (416) 795-1111. ❐

Review

THE PENTAX SB-L301 IMAGE SCANNER

A mid-range grey scale scanner, the Pentax SB-L301 offers impressive performance for desktop publishing and optical character recognition applications.

by CN! Staff

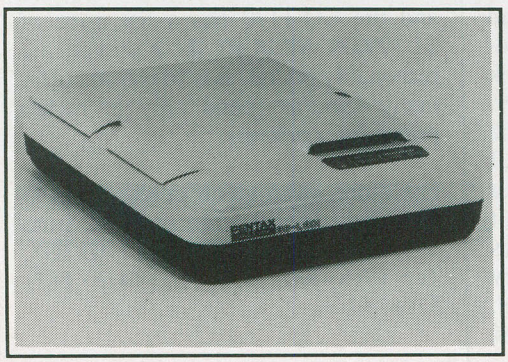
Scanning technology has taken a giant leap sideways of late. With the advent of "handy" scanners — low end scanners which scan documents with a mechanism not unlike a paint roller — a lot of really ugly scans have appeared. Handy scanners are much cheaper than traditional flatbed scanners, but their performance betrays their price.

The Pentax SB-L301 scanner is a true flatbed scanner which emulates the popular Hewlett-Packard ScanJet Plus. As such, it's immediately compatible with a number of workable scanner driver packages, including ImageIn and Grey F/X. It can produce line art and up to sixteen levels of grey. While its grey scale characteristics make it less than ideal for high end desktop publishing, it's not a bad choice if you'll be outputting your final pages on a three hundred dot per inch laser or if you'll be working with applications which involve only line art. The most notable of these, of course, is optical character recognition.

The Pentax SB-L301 has an interesting mix of features for a mid-range scanner platform, and is well worth considering if your requirements of a scanner are modest.

Five Hatchets

The SB-L301 can scan originals up to eight and a half by fourteen inches. It uses a charge coupled device light sensor mounted on a moving scanning arm, which makes it pretty stable and eliminates most of the scanning aberrations which older moving mirror scanner designs were subject to.



Charge coupled devices are solid state image sensors which have the advantages of being very small and having a relatively linear response to light. They have the arguable disadvantage of having a very non-linear response to colour. This means that if you scan a black and white photograph with a scanner based on one, you should wind up with a grey scale file that contains a pretty faithful reproduction of the original image. If you scan a colour photograph, you'll wind up with a grey scale file in which some areas appear to be missing.

Charge coupled image sensors usually start to fall apart at the upper end of the visible spectrum. The SB-L301 loses information which is printed in yellow or blue.

This does make its use a bit questionable if you'll be attempting to make grey scale files out of colour originals. However, it has a notable advantage, too, in that anything printed in these colours tends to be ignored by the scanner. If you scan a black and white original which has been marked up with a yellow highlighter, for example, the scanner will ignore the colours and only "see" the black.

This can be a very worthwhile feature if you'll be using the SB-L301 primarily as an input device for optical character recognition software.

It's worth noting that the SB-L301 has an optional thirty page sheet feeder, which will allow you to have it scan multiple pages without requiring that there be someone around to place each one on the scanning bed. Once again, this makes it a good input device for optical character recognition.

The SB-L301 can scan originals at up to three hundred dots per inch, adjustable in three dot per inch increments right down to thirty-nine dots per inch. Having this degree of control over the scanner's resolution is a worthwhile facility, as scanning an original with more resolution than you require will slow down the scanning process and create larger disk files than are really required.

It takes the SB-L301 about seventeen seconds to scan an original document.

Grey Effects

There are few other scanners in the price range of the SB-L301 which offer a mix of features as well suited for optical character recognition and line art applications. It's fast, easy to use and produces first class results. Its available document feeder makes the prospect of reading a lot of printed text through it pretty manageable — something that really can't be said of scanners which insist on being fed exclusively by hand.

The SL-L301's limit of sixteen grey levels does not really qualify it for high end desktop publishing. If you'll be having your final art output on a Linotron, grey scale images created by the SB-L301 will look notably less detailed than those created by a scanner with better grey level resolution. However, if your art will ultimately be output at no more than three hundred dots per inch, you should appreciate that halftones reproduced on a PostScript laser can really only represent about sixteen grey levels.

Having more grey levels than your printer can really print wastes time, disk space and your printer's memory. The specifications of the SB-L301 are a good match for most desktop publishing applications in this respect.

A scanning system with few faults and a lot going for it, the Pentax SB-L301 is a rugged, well engineered scanning solution when your requirements are modest and buying a more expensive scanner would clearly be overkill.

For more information contact Pentax Canada, 3131 Universal Drive, Mississauga, Ontario L4X 2E5, Sales: (416) 625-4930, Service: (416) 625-4980, Fax: (416) 625-8550 ❐

Review

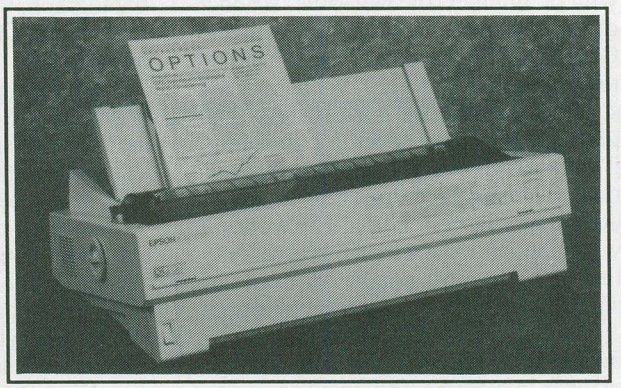
DOT MATRIX IS ALIVE AND WELL AND MAKING NEW INROADS

Review of Epson LQ-570 and LQ-1170, two new revolutionary 24-pin printers

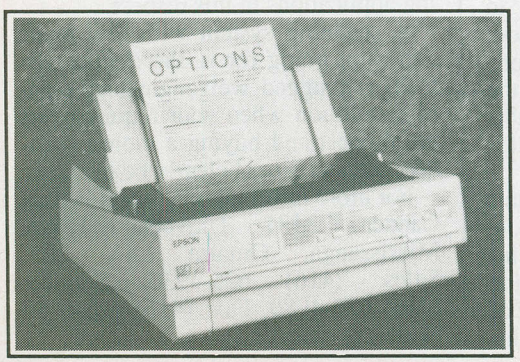
by Chuck Ander

It is definitely an industry first — scalable fonts in a dot matrix printer. Used to be you could only get scalable fonts with a laser printer (and only a high priced Postscript one at that). But this is only one part of Epson's new ESC/P 2 printer language which is standard in these models and in all future 24-pin printers from Epson. Other features included in ESC/P 2 include an enhanced graphics mode that places dots more accurately on the page for sharp, 360 x 360 dots-per-inch output and backward compatibility with the former ESC/P standard.

These printers are easy to use and set up. You have the choice of four paper paths. You can feed paper from the front, the bottom, the top or, if you like tradition, from the back. They come with an optional standard cut-sheet feeder that holds up to 50 sheets of bond paper or letterhead. A convertible push-pull tractor allows continuous paper, forms or labels to be loaded from the standard rear-push position. They can also convert into a pull-tractor that feeds continuous paper from the bottom or front positions. Single sheets can be fed from either the top or front. All these paper feeding options certainly add up to a generous measure of convenience.



A printer, however full-featured, is only as good as its software driver. Without this "magical" little piece of software, all the wonderful features in the world would be un-accessible. Fortunately, the LQ-570 and LQ-1170 come with drivers for WordPerfect 5.1, PlanPerfect 5.1, DrawPerfect 1.1., LetterPerfect 1.0, Microsoft Windows 3.0, Microsoft Word 5.5 and WordStar 6. I used the WordPerfect 5.1 driver and it only took seconds to select this new printer. Once that was done, all of the printers' features were available. I used WordPerfect's printer test file to test the printers and I wasn't disappointed. All of the features tested in this file worked very good on these new Epson printers. These included varying sizes of letters, symbol font sets, table features, shadow text, equations, inserted graphics and many others.



I created one more test file to test the many fonts offered. Resident in the printer are Courier, OCR-B, Orator, Prestige, Roman, San Serif and Script fonts. You may also use scalable (8 to 32 points) Roman and San Serif fonts.

The Epson LQ-570 lists for $599.00 and the LQ-1170 has a list price of $1,199.00. All in all, these printers are reasonably priced, easy to use and offer many features found only in higher priced laser printers.

For more information contact: Epson Canada Limited, 95 Mural Street, Suite 500, Richmond Hill, Ontario L4B 3G3, Tel: (416) 881-9955, Fax: (416) 881-5765. ❐

Review

BROTHER HL-8V LASER PRINTER

The Latest Technology for Advanced Text and Graphics Applications, Featuring Scalable Fonts and High Resolution Control

by CN! Staff

Utilizing its PCL 5 emulation, the HL-8V from Brother is fully compatible with the Hewlett Packard LaserJet III. Employing this new level of printer control, the HL-8V can scale any of its three outline typefaces to any point size from .25 to 999.75 points, yielding great flexibility in text layout. Brother's High Resolution Control means the end of the "jaggies." The HL-8V renders print quality that is free from "stair steps" and jagged edges in both text and graphics. Equally effective under any emulation, High Resolution Control gives any document a truly typeset look.

Compatibility

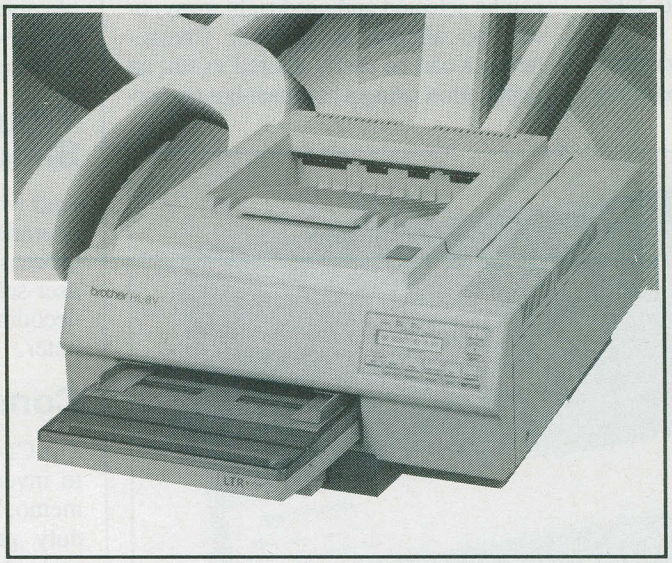
As well as being compatible with HP LaserJet III printer commands, the HL-8V offers IBM Proprinter XL, Epson FX-850, and Diablo 630 emulations. With such a high degree of flexibility, the HL-8V is compatible with virtually any PC software available today. With both parallel and serial interfaces this printer can be connected to any PC or network.

Maintenance

Using the industry standard engine, maintenance of the HL-8V is not difficult. Both the toner and drum are contained in a single, easily replaceable cartridge. With a rated life of 4,000 pages, the cartridge doesn't have to be changed very often, but when necessary, the process is fast and easy.

Data Compression Technology

Another innovation used in the HL-8V is called Data Compression. This technique allows the printer to describe areas of a graphic image by mathematical formulae rather than a series of numbers, thus reducing the amount of memory required for a given print job. The result of this technological development is that all print jobs, even an entire page of high resolution graphics, can be printed without the need for additional memory



Advanced Graphics Capabilities

Rather than only meet the specifications of PCL 5, Brother has chosen to give the HL-8V capabilities beyond that standard. While most laser printers can produce only eight different shading patterns, the HL-8V can produce 64 shading patters — to any degree chosen by the software. This gives far more intricate and detailed results in graphics printing.

Flexible Expansion

Brother's new MB-840V memory board comes with 1 megabyte of RAM standard, and also allows for expansion to 2, 3, or 4 megabytes of total on-board memory, just by adding RAM chips. The HL-8V is compatible with the large number of standard font cartridges available today, giving users unending typestyle possibilities. The HL-8V can also be upgraded to PostScript by adding the Brother CB-8PS board.

All in all, the HL-8V laser printer offers some very nice features. These include (among others): font scaling technology, multiple emulations, one megabyte of memory and its own enhanced graphics capabilities and high resolution control. With all that's going for it the HL-8V is quite a printer.

For more information contact: Brother International, 1, rue Hotel de Ville, Dollard des Ormeaux, Québec H9B 3H6, Tel: (514) 685-0600, Fax: (514) 685-1701. ❐

Review

C.Itoh CI-5000 HEAVY DUTY DOT MATRIX PRINTER

Rugged High-Speed Printer — Providing Heavy Duty Printing in a High Volume Printing Environment

by Chuck Ander

The rugged CI-5000 Dot Matrix impact printer from C. Itoh was designed to provide high speed, heavy duty printing in high volume printing environments.

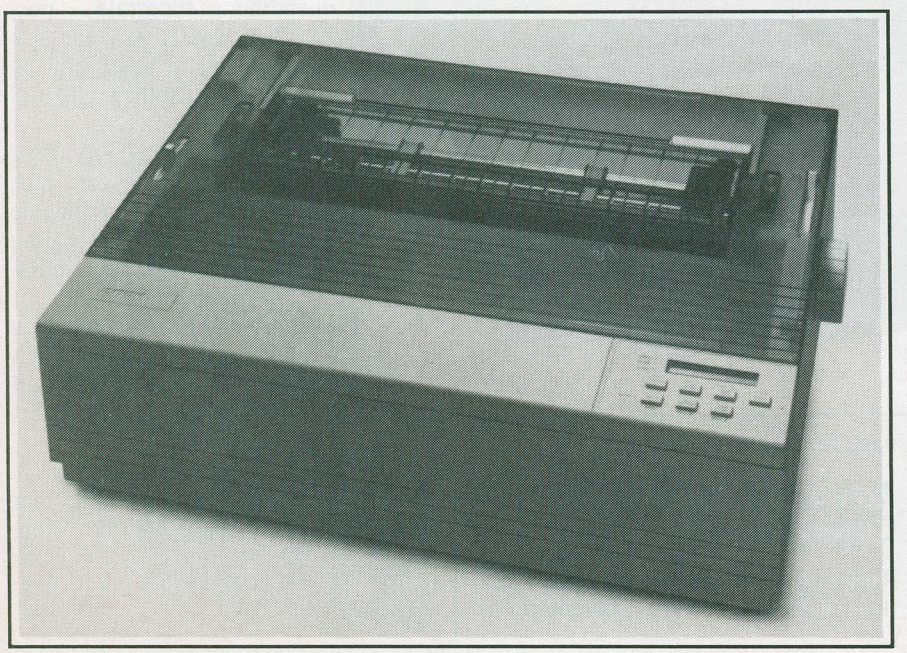
In the High-Speed Data Processing mode, the CI-5000 delivers 540 characters per second. In the Near Letter Quality mode, the CI-5000 can print 110 characters per second — as you can see from these numbers, it's really fast!!

In order to make this printer work with WordPerfect 5.1, I enabled the Printer Emulation mode, emulating an Epson. I chose the FX-86e as the printer in WordPerfect and it worked just fine, printing all the items in the printer test file. Other emulations available include: IBM Proprinter XL and DEC LA50/LA75/LA210.

With its wide (up to 17 inches) paper handling characteristics and blinding speed, the CI-5000 really shines in a heavy-duty, data processing environment. Its enclosed cabinet design enables you to place it in hostile environments, previously off-limits to printers.

Programmable Configurations for Flexibility and Ease of Use

With programmable configurations that can be stored and recalled later and single button set-up, users are provided with quick printer set-up for special jobs. A User Number system provides four memorized lists of control settings for instant use. Each User Number list can be selected and used right away, or can be altered as desired. Characteristics can be easily altered to suit an application using a compact but powerful multifunction control panel; its display window guides you through the choices. This flexibility enables the CI-5000 to meet the needs of multiple users and applications, making it an important tool for office productivity.



Greater Paper Handling Characteristics for Print Versatility

Both bottom and rear paper loading are available and paper may travel via top or rear exit, push-tractor, pull-tractor or friction-feed. A wide selection in types of forms, paper thickness, pin-feed (continuous paper, cut sheets or even envelopes provides versatility in applications printed. Also standard are zero-inch tear off, auto paper park and auto top of form.

Troubleshooting Simplified

And when you need to troubleshoot an operational problem, you'll find the process simplified by the CI-5000's user-selectable hex dump print mode, decoding data sent from the host computer.

Conclusion

The CI-5000 is not a printer you'd want to invest in to print the odd letter or memo. If, however, you have heavy-duty printing needs, possibly large-scale data processing or a hostile environment, this workhorse is the one for you.

For more information contact Doug Polzin, C. ITOH, 2120 Matheson Blvd. E., Mississauga, Ontario L4V 1E1. ❐

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There's nothing complicated about the new 1309 and 1324 printers from Brother. Small businesses, retailers and home users will be astounded by this combination of operational simplicity, extraordinary quality and affordability.

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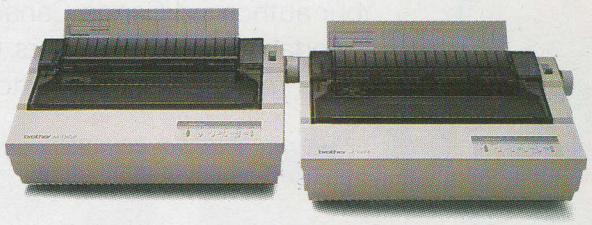

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Almost Free Software of the Month

Welcome to our new feature, "Almost Free Software of the Month." Each month we will feature an Almost Free Electronic & Scientific Software package, explain its features and show how it can be most effectively used. This month we are reviewing LEX, the Life Expectancy Program. LEX is on Volume 1 of Almost Free Electronic & Scientific Software.

by Chuck Ander

How long will you live? Do you have any idea? Would you want to know if you could? Well, of course, no one can really answer this question, but there are ways to possibly estimate our lifespan.

LEX starts out by asking your name and some information such as your age and sex. It goes on to ask questions concerning your lifestyle, the foods you eat and if your parents and/or grandparents are living. Each series of questions is presented on a different graphics screen, making filling out the questionnaire easy and enjoyable.

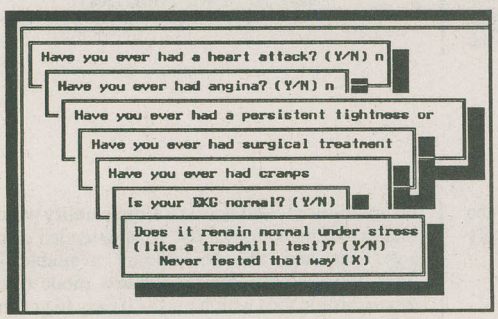

Fig. 1. Questions Asked by LEX

Then, LEX tells you how much longer an average person of your age could expect to live, and it then tells you, based on the answers to your questions, how long you may expect to live. LEX then offers suggestions for increasing your lifestyle (see Fig. 2.) Finally, LEX asks you if you wish to go back and change some of the parameters of the test to see what it will do for your life expectancy. For example, perhaps you'd like to see how many years you could add to your life if you quit smoking — or if you started a regular aerobics program.

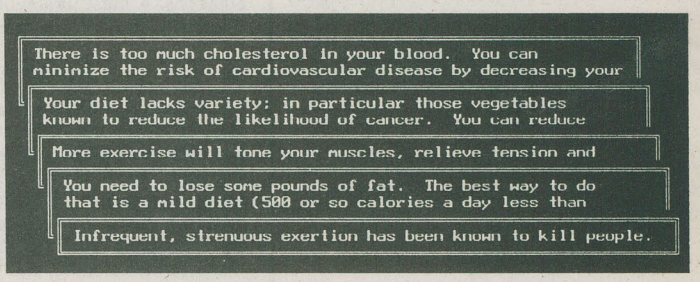

Fig. 2. Suggestions For A Longer Life by LEX

LEX is a good piece of software, and the author has put his feelings of compassion into it. The author of LEX has this to say about the program:

"LEX is a labour of love and desperation — a love of self and a fear of dying. I had quintuple bypass surgery on my heart, and I am extremely interested in being around a few more years. The bulk of this work was done while recuperating, and I made it as good as I could. Which is not to say it is representative of you, or of any one individual; LEX deals in population averages.

"Anyway, I formed this company in the fond hope of putting my knowledge to work and avoiding the stresses which helped make me what I am today...I wish you a long and healthy life. May your winds blow fair, your skies be clear and your LDL cholesterol be low." ❐

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Volume 1

Life Expectancy

LEX is intended to be an entertaining way to evaluate your life style by "predicting" how much longer you have to live. Obviously, there are no guarantees, but we have done the best we can with available data. The program is graphical, interactive (obviously) and I'd like to add very useful. In addition to providing a prediction of your life expectancy, LEX allows you to modify this prediction by changing one of the parameters, for example, the amount of red meat you eat or the amount of aerobic exercise you get. The program was written with great love by a person recovering from quadruple bypass surgery. It was created with the desire to encourage people to live long and enjoyable lives.

Eclipse

This little program calculates the date and time (forward or backwards in time) of any solar or lunar eclipse.

Gravity

Welcome to **Gravity 1.0!**

Have you ever wondered if planets can have stable orbits around a binary sun? Have you ever wondered what it would be like if a Jupiter-sized planet were to pass through our solar system? Perhaps you feel that life on Earth would be more fun if only our planet's orbit were not so boring. Gravity is designed to let you explore all these possibilities; it is designed to give you an intuitive feel for how a system will behave. By simply placing planets and dragging vectors you will be able to create entire solar systems and watch them behave under the influence of gravity. This program requires Microsoft Windows 3.0.

Chemistry Tutor

Chemistry Tutor is an excellent interactive program that teaches chemistry to kids (of all ages). The program starts by explaining the basic concepts of atoms and how they combine to form molecules. The program lets you move atoms together to combine them into molecules and, at the same time, explains the rules for these combinations. A must for anyone with curious kids! Requires EGA or VGA screen.

Almanac

Almanac is a calendar/information utility for the Microsoft Windows operating environment. It provides traditional calendar displays in month and year format as well as a popup desk set for day-to-day notes and schedules. Global configuration parameters can be configured to select the face and size of the display fonts used to compose the calendar, and the position and size of the main and popup windows. Configuration files (auto-load modules) and overlays allow you to customize calendars for all of your business and personal needs. The types of events Almanac will calculate include weekly, monthly, and annual events by day or date, as well as birthdays, wedding anniversaries, and others. Up to ten overlays may be specified in a configuration file.

In addition, Almanac auto-load modules allow you to configure options for calculating religious holidays (Christian and/or Jewish), phases of the moon, and calendar mode (Gregorian/Jewish). A location data base is used to select a geographic location for each auto-load module. This information is used to calculate the time and azimuth of sunrise and sunset for each day. All of the menu selections under 'Config' are stored in the auto-load module except the master directory path.

Psychiatric Medical Database

PsyMed is quick reference guide to the psychotropic medications. The software provides quick and easy access to over 130 medication definitions commonly needed by Mental Health professionals and others. With PsyMed you avoid the drudgery of searching through various medication books to find the medication you need information on. The information can be accessed instantaneously by various PsyMed "search" functions or by keying in a complete brand name spelling.

PsyMed provides condensed Indications, Adverse Reactions, Dosage, and Visual Identification information on all psychotropic medications contained in its' files.

Note: This program is really big, so it requires either a high density floppy drive or a hard disk to unarchive it.

$24.95 (Two Disk Set)

Volume 2

AMPTOOLS

Amptools is a wonderfully designed, easy to use program to automatically calculate the wire size, fuses, crossover capacitors and other functions when setting up a speaker system. Save hours of time and tedious calculations with this simple program. Just answer the prompts, type in the information and the answers are immediately presented to you.

Resistor Band Decoder

Do you have trouble remembering the standard resistor colour codes and have fits trying to apply the multiplier? Well here is a simple utility which makes extensive use of the IBM extended character set and the 16 colours available in EGA/VGA 80 column colour text mode (uses monochrome too) which makes it easy to get any resistor value.

The Resistor Band Decoder is a small useful utility which will give the value in ohms of a standard resistor given the colour of the bands which appear on the resistor. The program is simple enough to use, just start the program and it will prompt you for a two letter code for each band. The codes are available on the screen at all times. A representation of the resistor appears on the screen, and the colour bands will appear as you enter the codes for each band. Once you have entered all four colour bands, the resistor value and tolerance is displayed. A prompt to decode more resistors appears on the screen. The program terminates when you do not want to decode any more resistors.

Listening Room

Listening Room is software designed to minimize the effects of standing waves by determining desirable speaker and listener placement within the audio environment. Sitting in room locations where hot spots or nulls are absent provides a more natural, smoother response, removes the need for excessive equalization and reduces transient decay time.

The Listening Room runs on any IBM compatible machine with DOS 2.11 or better, 256K of RAM and Hercules compatible, CGA colour, EGA colour and VGA colour monitors.

Standing Waves

Due to the nature of home listening environments, low frequency standing wave patterns develop within the room which alter the apparent FREQUENCY RESPONSE and TRANSIENT DECAY TIME of the audio playback system. Standing waves exhibit themselves as pockets of low and high acoustic pressures and may be readily observed by walking around within the listening room while steady state, bass rich material is being reproduced. The response variations, which can exceed 25 db at different listening positions, cannot be properly compensated for by an electronic equalizer.

Of the various solutions to the standing wave problem, adjusting the loud-speaker and listening positions is the least expensive, most practical and often the most effective solution for the average homeowner or apartment dweller. If you are currently considering extreme measures to improve what your believe to be a problem room, use this program first. Many times, no further work will be required.

CW

CW was written to help prospective hams overcome what many perceive to be the biggest obstacle to obtaining an amateur radio license—learning the Morse code. There are numerous programs available in the public domain which send Morse code via a PC's speaker, but most are very limited and are written in BASIC, which requires a clumsy interpreter. CW seeks to provide a comprehensive program which provides several modes of learning and practising the code. The best features of other programs are included and many new features have been added to those previously available.

Hampac

Hampac is a wonderful program for anyone who is concerned for amateur radio, especially someone who is studying for their government test. It is an interactive program that asks questions and lets you answer. It also grades you on your answers. The program includes a novice theory test, a technical test, an advanced test, morse code practice, a simple calculator and a module to let you calculate four different types of antennas.

HOWTOFAX

Receiving Weather Satellite Imagery: A Beginner's Primer

Dedicated to satellite tracking, decoding of NOAA/Soviet meteorological satellite telemetry, and Digital Image Processing of satellite pictures.

How to Receive APT Pictures From the NOAA Satellites

So you have decided you want to receive the NOAA and Russian METEOR orbiters and you have a radio that receives 137.500 MHz and a computer. So now what do you do? This short dissertation will steer you in the correct direction.

Cordless

Ever wondered how to listen to cordless phone conversations. What frequencies are they on? Well here's the frequencies for the new cordless phones. You can set the channels up on most scanners so you can listen in on the neighbourhood gossip, etc.

You should be able to hear both sides of the conversation on either the base or handset frequencies due to the telephone hybrid circuitry.

Yagi

YAGI-UDA helps work out YAGI antenna calculations. Just run it... it explains itself.

BDS

BDS is an engineering calculator that pops up from within any application. Just run it to load it into memory and hit Alt plus the tab key to make it appear.

BDS will calculate distance & azimuth, coordinates, depression angle, wavelength, FM blanketing contour, distance to radio horizon and inductance and capacitance. It will also function as a metric converter—a handy piece of software to have around.

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History

Joining Two Worlds: De Forest and the Development of Radio

by George Colpitts

In March 1912, Lee de Forest — inventor, electrical engineer and wireless promoter — was ushered into a Palo Alto, CA courtroom to face fraud charges. Also arrested were de Forest's patent lawyer and directors from a number of subsidiary wireless telephone ventures, all employed within the inventor's umbrella company, the Radio Telephone Company.

The creator of the "De Forest" telegraph system was not new to courtroom controversy. His designs had been picked apart in patent trials innumerable times, and his first stormy divorce had received much courtroom publicity. But the fraud charges were much more serious, and the press gallery was packed to watch whether the inventor would be discredited, fined and/or imprisoned.

The press knew de Forest well. He had burst into the news as early as 1902 with the Herculean claim that he would "move all heaven and earth to put in at once a broad fundamental patent on telephony without wires by Hertzian waves."

Already by 1905, de Forest seemed to be succeeding, installing the first wireless communication between Havana and New York City, relaying the messages through stations in Havana, Key West, Concho, Hatteras, and Atlantic City.

De Forest "broadcasting" in 1907, from his Manhattan lab.

In 1905, de Forest had claimed he could send messages as far as Marconi could with small, 1 kW transmitters and using 20 to 50 x less power. Moreover, a year before Marconi sent the first successful wireless message across the Atlantic, "joining two worlds," de Forest had sent about 500 words of a 1000-word message from Ireland to New York City.

No wonder then that the press was interested in the fraud case: the outcome could clearly upset an American favourite in the wireless struggle. Moreover, as witnesses and company officials took the stand, it became very obvious that directors had either committed, or allowed to take place, fraudulent promotion of de Forest's company.

The stock scam's nature was quite clear. In 1906 the Radio Telephone Company had won contracts to install wireless telephones on board navy ships. But the early phones were unreliable, short-ranged and interfered with on-board telegraph equipment. By 1908, the navy had

abandoned use of de Forest's wireless altogether.

The company, however, had never told stockholders of the failed contract, and to maintain stockholder confidence, some officials had created subsidiary wireless phone companies to attract cash. That cash was used, the prosecutor proved, to pay dividends on the floundering company. The stock transfers and inflated company claims all smacked of fraud.

The *New York Times* devoted prominent coverage to the scandal when de Forest, the tall, handsome inventor finally took the stand as Christmas Day neared, and told about his life and connection to the fraudulent companies. That testimony provided a valuable synopsis of a varied and interesting career.

In the late 1800s, de Forest explained, he had borrowed $50 after graduating from Yale to go to Chicago, then the centre of U.S. electrical engineering. There he had assisted at a small electrical company before landing an editor job with the *Western Electrician*. He was paid $10 a week, but the salary was soon cut to $5 when it became clear that de Forest was spending less time writing than he was experimenting with wireless equipment.

De Forest's testimony described the poverty he experienced while selling stock in his first wireless companies and the harsh working conditions. In the winter of 1904, he connected Cleveland and Buffalo wirelessly, himself manning one of the transmitting stations. "I shall never forget the icy dreariness of that lonely location...," he wrote much later, "the agony of raising again and again that fan aerial after sleet had piled [up on] it and the stiffened hemp halyards an inch thick in ice...."

The testimony filled a full day of court, and included de forest's demonstration of wireless technology, transmitting a message through one of the courtroom's oak doors. That finished, the trial was adjourned until after Christmas day, when the jury would decide its verdict.

The stock scam had caught de Forest just as he was vying for position in a wildly speculative wireless race mostly between himself and the Italian Guglielmo Marconi. Both men were using in different ways John Fleming's invention, the Fleming Valve, as a means to detect Hertzian waves. Marconi had bought Fleming's innovation outrightly and used it in all his wireless designs which were floating on Canard ship lines or beaming, somewhat ineffectively, from coastal towers.

De Forest demonstrating wireless at the 1904 World Exposition in St. Louis, where he won the Grand Prize and Gold Medal for sending messages to Chicago.

De Forest, however, had used some of Fleming's ideas (and got stung for it in patent court) but built on them significantly. Fleming, it should be remembered, had noticed that by putting a metal-wire electrode with a positive charge into a light bulb, a user could detect Hertzian waves. The innovation was the first radio vacuum tube, or the diode.

De Forest eventually added to Fleming's concept a zigzag wire grid between the filament and a metal-plate electrode to carry incoming messages, constructing the first triode. That was by 1907, and he called the device the "Audion", which he later said was "the granddaddy of all the vast progeny of electronic tubes that have come into existence since."

But the fact that he had used a vacuum bulb was enough to incite court battles with Marconi, and from 1905 to the end of the First World War, and long after the fraud trial, newspapers kept abreast of appeals and new charges, most of them laid by Marconi.

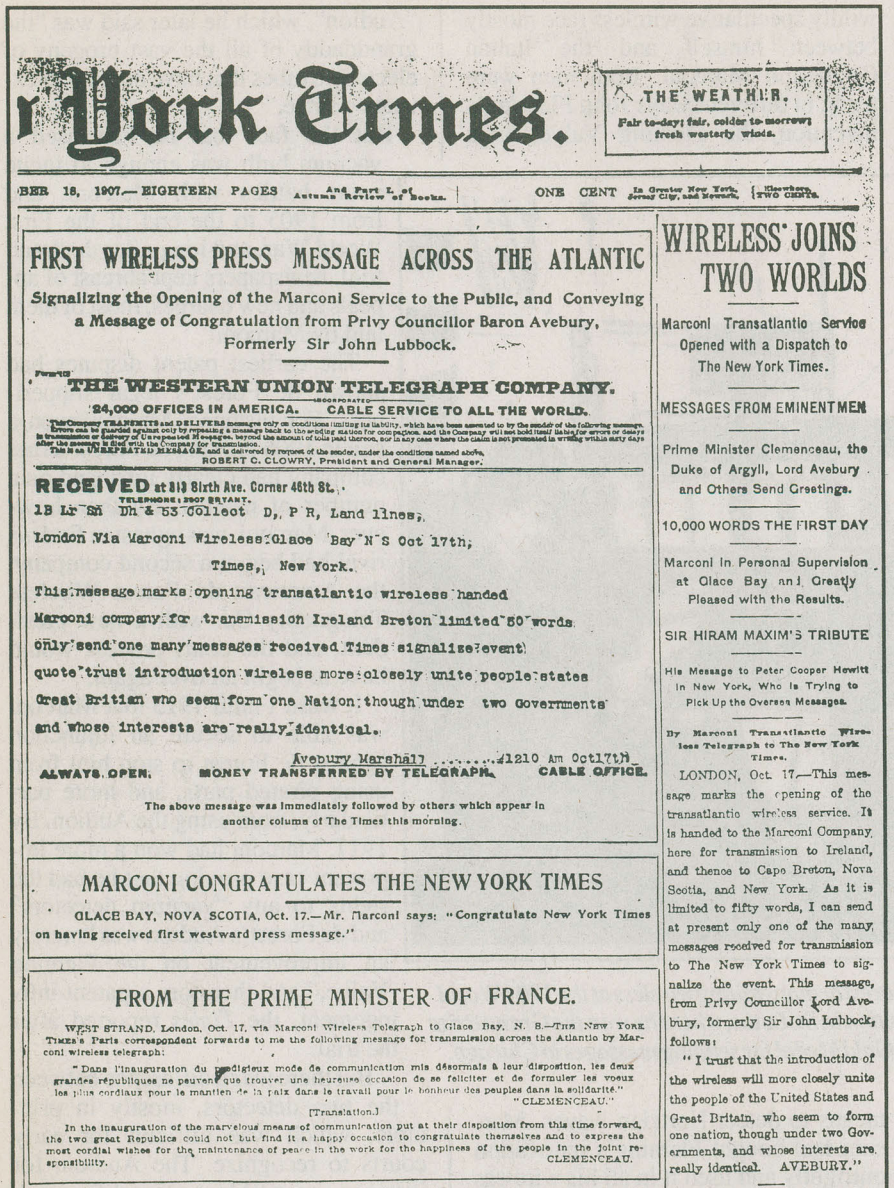
The earliest patent disputes had shown de Forest's legal slipperiness. For instance, Marconi won a suit in 1906 proving de Forest's first company had clearly infringed on a number of patents. By then however, Marconi, was aghast to find his rival had begun a second company, the American de Forest Wireless Telegraphy Co. with a new president, and the court process would have to begin all over again.

It wasn't until 1915 that Marconi was able to secure an injunction against de Forest to stop him from using pirated parts, and more particularly, from using the Audion. By 1917, Marconi had won a more important case proving that he had the rights to any "vacuum detectors" and de Forest's Audion was "merely an improvement on the Fleming Valve," and therefore a patent infringement, the *Times* reported after the trial.

But there *was* a difference between the two detectors, mostly in principle, which was difficult for early courts to recognize. The Audion, for instance, was able to amplify weak electrical currents and by 1912, de Forest found the Audion could obtain a range of musical tones in the receiver. It was at that time de Forest had added "feedback" interconnection between the input and output circuits, creating "regeneration."

The Audion, therefore, became an integral component in de Forest's first wireless phone or radio demonstrations when he transmitted music into the main lobby of the Hotel Astor in New York in 1916.

By 1920, de Forest was transmitting the "bottled wireless" (a term given to the modulating circuit in the tube), 900 miles using low wavelength, low-power transmissions.



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Signalizing the Opening of the Marconi Service to the Public, and Conveying a Message of Congratulation from Privy Councillor Baron Avebury, Formerly Sir John Lubbock.

Form 12
THE WESTERN UNION TELEGRAPH COMPANY.
INCORPORATED
24,000 OFFICES IN AMERICA. CABLE SERVICE TO ALL THE WORLD.

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This is an UNREPEATED MESSAGE, and is delivered by request of the sender, under the conditions named above.
ROBERT C. CLOWRY, President and General Manager.

RECEIVED at 218 Sixth Ave. Corner 46th St.,
TELEPHONE: 2907 BRYANT.

1B Lr Sn Dh & 53 Collect D, P R, Land lines,
London Via Marconi Wireless Glace Bay N S Oct 17th,
Times, New York.

This message marks opening transatlantic wireless handed Marconi company for transmission Ireland Breton limited 50 words only send one many messages received Times signalise event quote trust introduction wireless more closely unite people states Great Britian who seem form one Nation though under two Governments and whose interests are really identical.

Avebury Marshall .....1210 Am Oct17th

ALWAYS OPEN. MONEY TRANSFERRED BY TELEGRAPH. CABLE OFFICE.

The above message was immediately followed by others which appear in another column of The Times this morning.

MARCONI CONGRATULATES THE NEW YORK TIMES

GLACE BAY, NOVA SCOTIA, Oct. 17.—Mr. Marconi says: "Congratulate New York Times on having received first westward press message."

FROM THE PRIME MINISTER OF FRANCE.

WEST STRAND, London, Oct. 17, via Marconi Wireless Telegraph to Glace Bay, N. S.—THE NEW YORK TIMES's Paris correspondent forwards to me the following message for transmission across the Atlantic by Marconi wireless telegraph:

"Dans l'inauguration du prodigieux mode de communication mis désormais à leur disposition, les deux grandes républiques ne peuvent que trouver une heureuse occasion de se féliciter et de formuler les voeux les plus cordiaux pour le maintien de la paix dans le travail pour le bonheur des peuples dans la solidarité."
"CLEMENCEAU."

[Translation.]
In the inauguration of the marvelous means of communication put at their disposition from this time forward, the two great Republics could not but find it a happy occasion to congratulate themselves and to express the most cordial wishes for the maintenance of peace in the work for the happiness of the people in the joint responsibility.
CLEMENCEAU.

WIRELESS JOINS TWO WORLDS

Marconi Transatlantic Service Opened with a Dispatch to The New York Times.

MESSAGES FROM EMINENT MEN

Prime Minister Clemenceau, the Duke of Argyll, Lord Avebury and Others Send Greetings.

10,000 WORDS THE FIRST DAY

Marconi in Personal Supervision at Glace Bay and Greatly Pleased with the Results.

SIR HIRAM MAXIM'S TRIBUTE

His Message to Peter Cooper Hewitt in New York, Who Is Trying to Pick Up the Overseas Messages.

By Marconi Transatlantic Wireless Telegraph to The New York Times.

LONDON, Oct. 17.—This message marks the opening of the transatlantic wireless service. It is handed to the Marconi Company here for transmission to Ireland, and thence to Cape Breton, Nova Scotia, and New York. As it is limited to fifty words, I can send at present only one of the many messages received for transmission to The New York Times to signalize the event. This message, from Privy Councillor Lord Avebury, formerly Sir John Lubbock, follows:

"I trust that the introduction of the wireless will more closely unite the people of the United States and Great Britain, who seem to form one nation, though under two Governments, and whose interests are really identical. AVEBURY."

MARCONI'S CONGRATULATIONS.

The* New York Times *1907 announcement of Marconi's trans-Atlantic wireless message. De Forest and Marconi were rivals in the industry, both competing for patents on the "vacuum detectors."

But de Forest's real legal battles began during the 1920s, not with Marconi who eventually had to drop the issue, but with a number of other innovators who claimed to have invented the regenerative circuit. In particular, de Forest weathered ten years of legal battles with Edwin H. Armstrong, finally ending with the Supreme Court decision in 1934 that de Forest was the first inventor of the "so-called feedback circuit."

While de Forest's professional life was a perpetual struggle (he was later sued, albeit unsuccessfully, for $500,000 by one of his company's presidents) the inventor's love life swirled with controversy also.

His first marriage was to magazine editor Lucille Sherdowne after a short "wireless romance," as newspapers termed it. De Forest, as most hobbyists would, had wooed Lucille by setting up a wireless apparatus in her mother's home and sending Lucille love messages in Morse Code. Eight months later, the *New York Times* reported that de Forest was filing for divorce, and suing a brewer for $50,000 for the "alienation of Mrs. De Forest's affection." Sherdowne pleaded that de Forest was simply a jealous madman and pointed out that he had once tried to storm a New York hotel room with four detectives to prove her unfaithfulness.

The inventor's second marriage, to the militant suffragist Nora Stanton Blatch, was breaking apart by the time the fraud case was decided. By 1911, de Forest would be suing for divorce claiming Blatch spent more of her time winning the vote for women and studying to become a hydraulic engineer, than being a wife to him. Moreover, Blatch's suffragist campaigns often gave de Forest the wrong type of publicity. When he had constructed a wireless telephone on the top of New York city's Terminal Building, (he had also installed them on airplanes and race cars with long detector poles angling out of them) Nora demonstrated the invention by phoning suffragist messages to curious onlookers, sufficiently offending them to complain to the *Times*.

De Forest's personal problems seemed heightened by his electrical developments. By 1922, when de Forest was in court trying to transfer financial support of his daughter onto Nora's new husband, the inventor developed another exciting innovation, the "Phonofilm", which introduced the "talking" movie to the motion picture industry. He had printed soundpaths along the margin of films and used a "photion", or a glass tube emitting violet light to "read" the sound. Newspapers, sensing correctly the dawn of a new age, printed page-long stories about how de Forest's "Talkie" films worked.

It wasn't until the age of 57, by then removed from the maelstrom of electrical work, court trials and experimenting, when de Forest seemed to find happiness. He married the young film star Marie Mosquini, whom he lived with and loved until his death at the age of 87.

When the Palo Alto case reconvened just before New Year's Eve, and

see **de Forest**, *page 43*

Field Day

by Bob Havens, VE3IYO (VE3MPS)

Does Mexico City and 1968 bring a picture to mind? I close my eyes and can still see Bob Beaman with his feet tucked around his ears shattering the world long jump record. What is more incredible is that his record is still in place after 23 years. Only the gathering of the world's best can produce such amazing results. So it is with Amateur Radio and field day!

Local Clubs

My induction to amateur radio involved a year of C.B. communication, dances and other gatherings followed by a winter course near my home and then the D.O.C. exam. It worked out well. We had just moved to Mitchell and were making new friends. Al (Whipper Snapper) and Dorothy (Buttons) from our C.B. days have remained our closest friends. Times change and the C.B. clubs just don't exist in the same way as they did back in the late '70s. I recommend you search out a local ham club and attend one of their meetings. Our Stratford club has several unlicensed members who are studying to become amateurs or who just enjoy short wave radio communications and the company of others who do as well.

I can't imagine my interest or enthusiasm for ham radio continuing on steadily from year to year as it has without the abundance of local radio clubs to spark my fervour. Although you don't need to belong to ANY amateur organization to have fun and be active they offer support and companionship — much needed commodities in today's busy, non-personal world. To thoroughly enjoy the full impact of field day, attend a club site.

What And Why

Do you remember the Jamaican hurricane or the Mexican earthquake of a few years back? If so, you have the why. Any time of the day or night you can tune my Drake transceiver and listen to two people talking somewhere around the world. It might only be someone in Toronto in conversation with someone else in Ottawa or it could be a ham in British Columbia meeting a time schedule with his buddies back in Great Britain. It is always busy — much like a global party line! When disaster strikes anywhere on planet earth you will hear very specialized conversations on the Drake. They involve hams from that country relaying messages of need and safety to other family members in a country far removed from the disaster. Often it is the ONLY form of communication these people have with the outside world!

This may spring forth a very logical question in your mind. You may recall seeing great arrays of antennae lurching skyward and being informed they belonged to a ham. If so, wouldn't they be destroyed during an earthquake or hurricane? The answer is — yes. All hams keep spare wire for any untold emergency. Part of the fun in this hobby is to see how well you can do with your home-made antennae and during the times of such emergencies they are all you would have. There is often a ham operator on the air within an hour of any disaster. Field Day affords amateurs the opportunity to practise emergency procedures much as you would do with a

See **Field Day**, *page 35*

In Background, L-Freddy The Face, R-Crazy Jimmy, Foreground, Binary Bob

Babani Books

New Releases

BP265: MORE ADVANCED USES OF THE MULTIMETER $11.80
This book is primarily intended as a follow-up to BP239, and also should be of value to anyone who already understands the basics of voltage testing and simple component testing.

BP266: ELECTRONIC MODULES AND SYSTEMS FOR BEGINNERS $15.80
This book describes over 60 modular electronic circuits — how they work, how to build them, and how to use them. The modules may be wired together to make hundreds of different electronic systems, both analogue and digital. To show the reader how to begin building systems from modules, a selection of over 25 electronic systems are described in detail, covering such widely differing applications as timing, home security, measurement, audio, games and remote control.

BP276: SHORT WAVE SUPERHET RECEIVER CONSTRUCTION $11.80
The basic short wave receiver described in this book is a superhet type having separate mixer and oscillator stages, two i.f. stages, a ceramic filter to provide good selectivity and a simple audio amplifier which will drive headphones. An optional b.f.o. permits reception of c.w. and s.s.b.

BP277: HIGH POWER AUDIO AMPLIFIER CONSTRUCTION $15.80
This book provides background information on high power audio amplifiers, together with some practical designs capable of output powers of up to 300 to 400 watts r.m.s.

BP278: EXPERIMENTAL ANTENNA TOPICS $11.80
Although nearly a century has passed since Marconi's first demonstrations of radio communication, there is still research and experiment to be carried out in the field of antenna design and behaviour. This is a practical book with text closely supported by diagrams. Some formulae and simple graphs are also included.

BP282: UNDERSTANDING PC SPECIFICATIONS $15.80
If you require a microcomputer for business applications, or a high quality home computer, an IBM PC or compatible is often the obvious choice. They are competitively priced, and are backed up by an enormous range of applications programs, hardware add-ons, etc. The main difficulty for the uninitiated is deciding on the specification that will best suit a person's needs. This book explains PC specifications in detail, and the subjects covered include: types of PCs, math co-processors, memory, display adaptors and more.

BP285: A BEGINNERS GUIDE TO MODERN ELECTRONIC COMPONENTS $15.80
It is easy for beginners and advanced users alike to become confused by the wide range of components currently available. In this book, the basic functions of the components are described. The main thrust of the book is concerned with practical aspects such as colour codes, deciphering code numbers and the suitability of components for given applications. Essential reading for all electronic enthusiasts, this book presents a vast amount of invaluable information to enable you to select the right components every time.

BP290: AN INTRODUCTION TO AMATEUR COMMUNICATION SATELLITES $15.80
Communications and broadcast satellites are normally inaccessible to individuals. There are a large number of amateur communications satellites in orbit around the world, and they can be tracked and their signals received with relatively inexpensive equipment. This equipment can be connected to a home computer such as the IBM compatible, for the decoding of received signals. This book describes several currently available systems, their connection to an appropriate computer and how they can be operated with suitable software.

BP292: PUBLIC ADDRESS LOUDSPEAKER SYSTEMS $15.80
The loudspeaker system is a critical part of any public address installation. All too often it is woefully inadequate, resulting in poor intelligibility and unnatural reproduction. We here examine the various systems and their drawbacks, and describe LISCA, the Line-Source Ceiling Array. This gives astonishing clarity, even coverage, reducing feedback, natural source location and even a pseudo-stereo effect. It promises to be the ultimate system for small to medium sized halls. Full step-by-step construction and installation details are given.

BP293: AN INTRODUCTION TO RADIO WAVE PROPAGATION $15.80
Radio wave propagation, one of the more important discoveries made in the early 20th century, has its origins in the world of solar physics. The sun's radiation provides the mechanism for the formation of the ionosphere. How the ionosphere is formed, and how it provides long-distance communication, is carefully explained. Non-ionic propagation, including "moonbounce" or satellite communications, is covered as well.

BP7: RADIO AND ELECTRONICS COLOUR CODE AND DATA CHART $3.00
Opens out to Wall Chart and includes many Radio & Electronics Colour Codes in use in UK, USA, Europe and Japan. Covers Resistors, Capacitors, Transformers, Field Coils, Fuses, Battery Leads, etc.

BP37: 50 PROJECTS USING RELAYS, SCR's & TRIACS $7.80
F.G. Rayer, T. Eng., (CEI), Assoc.IERE.
Relays, bi-directional triodes (TRIACs), and silicon controlled rectifiers (SCRSs), have a wide range of applications in electronics today. This book gives practical working circuits which should present a minimum of difficulty for the enthusiast.. Most circuits include a wide latitude in component values allowing easy modification and adaptation.

BP42: 50 SIMPLE L.E.D. CIRCUITS $5.85
Contains 50 interesting and useful circuits and applications, covering many different branches of electronics, using one of the most inexpensive and available components.

BP44: IC 555 PROJECTS $10.00
E.A. Parr, B.Sx., C. Eng., M.I.EE.
Every so often a device appears that is so useful that one wonders how life went on before it. The 555 timer is such a device included in this book are Basic and General Circuits, Motor Car and Model Railway Circuits, Alarms and Noise Makers as well as a section on the 556, 558 and 559 timers.

BP48: ELECTRONIC PROJECTS FOR BEGINNERS $7.80
F.G. Rayer, T. Eng. (CEI), Assoc.IERE
In this book, the newcomer to electronics will find a wide range of easily made projects. Also, there are a considerable number of actual components and wiring layouts, to aid the beginner.

BP49: POPULAR ELECTRONIC PROJECTS by R. A. Penfold $10.00
Includes a collection of the most popular types of circuits and projects which will provide a number of designs to interest most constructors. The projects are divided into four basic types. Radio Projects, Audio Projects, Household Projects and Test Equipment.

BP51: ELECTRONIC MUSIC AND CREATIVE TAPE RECORDING $5.85
This book sets out to show how Electronic Music can be made at home with the simplest and most inexpensive equipment.

BP53: PRACTICAL ELECTRONIC CALCULATIONS AND FORMULAE $11.75
A book that bridges the gap between complicated technical theory and the cut and try method.

BP59: SECOND BOOK OF CMOS IC PROJECTS $7.80
This book carries on from its predecessor and provides a further selection of useful circuits, mainly of a simple nature. The book is well within the capabilities of the beginner and more advanced constructor.

BP— ELEMENTS OF ELECTRONICS — AN ON-GOING SERIES $11.80 EACH
OR ALL 5 BOOKS FOR $44.00
F.A. Wilson, C.G.I.A., C.Eng.,
Although written for readers with no more than ordinary arithmetical skills, the use of mathematics is not avoided, and all the math required is taught as the reader progresses. Each book is a complete treatise of a particular branch of the subject and therefore, can be used on its own with one proviso, that the later books do not duplicate material from their predecessors, thus a working knowledge of the subjects covered by the earlier books is assumed.

BP62: BOOK 1.
This book contains all the fundamental theory necessary to lead to a full understanding of the simple electronic circuit and its main components.

BP63: BOOK 2.
This book continues with alternating current theory without which there can be no comprehension of speech, music, radio, television or even the electricity utilities.

BP64: BOOK 3.
Follows on semiconductor technology, leading up to transistors and integrated circuits.

BP77: BOOK 4.
A complete description of the internal workings of microprocessor.

BP89: BOOK 5.
A book covering the whole communication scene.

BP78: PRACTICAL COMPUTER EXPERIMENTS $5.25
The aim of this book is to enable the reader to simply and inexpensively construct and examine a number of basic computer circuit elements and gain a fuller understanding of how the computer chip works.

BP84: DIGITAL IC PROJECTS $7.80
F.G. Rayer, T. Eng. (CEI), Assoc.IERE.
This book contains both simple and more advanced projects for the reader developing a knowledge of the workings of digital circuits. To help the newcomer to the hobby the author has included a number of board layouts and wiring diagrams.

BP72: A MICROPROCESSOR PRIMER $5.25
In an attempt to give painless approach to computing, this inexpensive book will start by designing a simple computer and then the short-comings of this simple machine will be discussed and the reader is shown how these can be overcome.

BP74: ELECTRONIC MUSIC PROJECTS $10.00
R.A. Penfold
Although one of the more recent branches of amateur electronics, electronic music has now become extremely popular. The purpose of this book is to provide the constructor with a number of practical circuits for the less complex items of electronic music equipment, including such things as a Fuzz Box, Waa-Waa Pedal, Sustain Unit, Reverberation and Phaser Units, Tremolo Generator, etc.

BP85: INTERNATIONAL TRANSISTOR EQUIVALENTS GUIDE $9.00
Designed to help the user find possible substitutes for a popular user-oriented selection of modern transistors and includes devices produced by over 100 manufacturers.

BP92: ELECTRONICS SIMPLIFIED - CRYSTAL SET CONSTRUCTION $5.25
This is a book written especially for those who wish to participate in the intricacies of electronics.

BP94: ELECTRONIC PROJECTS FOR CARS AND BOATS $7.80
R.A. Penfold
Projects, fifteen in all, which use a 12V supply are the basis of this book. Included are projects on Windscreen Wiper Control, Courtesy Light Delay, Battery Monitor, Cassette Power Supply, Lights Timer, Vehicle Immobiliser, Gas and Smoke Alarms.

BP95: MODEL RAILWAY PROJECTS $7.80
Electronic projects for model railways are fairly recent and have made possible an amazing degree of realism. The projects covered included controllers, signals and sound effects: stripboard layouts are provided for each project.

BP98: POPULAR ELECTRONIC CIRCUITS, BOOK 2 $9.00
R.A. Penfold
70 plus circuits based on modern components.

BP101: HOW TO IDENTIFY UNMARKED IC's $1.95
An unusual and fascinating chart that is highly recommended to all those interested in electronics and which will hopefully pay for itself many times over, by enabling the reader to use IC's that might otherwise have been scrapped.

BP103: MULTI-CIRCUIT BOARD PROJECTS by R.A. Penfold $7.80
This book allows the reader to build 21 fairly simple electronic projects, all of which may be constructed on the same printed circuit board. Wherever possible, the same components have been used in each design so that with a relatively small number of components and hence low cost, it is possible to make any one of the projects or by reusing the components and P.C.B. all of the projects.

BP106: MODERN OP-AMP PROJECTS by R. A. Penfold $7.80
Features a wide range of constructional projects which make use of op-amps including low-noise, low distortion, ultra- high input impedance, high slew-rate and high output current types.

BP110: HOW TO GET YOUR ELECTRONIC PROJECTS WORKING $7.80
R.A. Penfold
We have all built circuits from magazines and books only to find that they did not work correctly, or at all, when first switched on. This book will help the reader overcome these problems by indicating how and where to start looking for many of the common faults that can occur when building up projects.

BP111: AUDIO $14.00
Covers a wide range of material from analysis of the sound wave, mechanism of hearing, acoustics, microphones and loudspeakers, amplifiers, and magnetic disc recording.

BP115: THE PRE-COMPUTER BOOK $5.85
Aimed at the absolute beginner with no knowledge of computing, this entirely non-technical discussion of computer bits and pieces and programming is written mainly for those who do not possess a microcomputer but intend to one day own one.

BP118: PRACTICAL ELECTRONIC BUILDING BLOCKS – BOOK 2 $7.60
R.A. Penfold
This sequel to BP117 is written to help the reader create and experiment with his own circuits by combining standard type circuit building blocks. Circuits concerned with generating signals were covered in Book 1, this one deals with processing signals.

BP121: HOW TO DESIGN AND MAKE YOUR OWN PCBs $5.85
The purpose of this book is to familiarize the reader with both simple and more sophisticated methods of producing printed circuit boards. The book emphasizes the practical aspects of printed circuit board designs and construction.

BP122: AUDIO AMPLIFIER CONSTRUCTION $6.75
A wide circuits is given, from low noise microphone and tape head preamps to a 100W MOSFET type. There is also the circuit for 12V bridge amp giving 18W. Circuit board or stripboard layout are included. Most of the circuits are well within the capabilities of even those with limited experience.

BP125: 25 SIMPLE AMATEUR BAND AERIALS $5.85
This book describes how to build 25 amateur band aerials. The designs start with the simple dipole and proceed to beam, triangle and even a mini-rhombic.

BP127: HOW TO DESIGN ELECTRONIC PROJECTS $9.00
Although information on stand circuits blocks is available, there is less information on combining these circuit parts together. Practical examples are used and each is analyzed to show what each does and how to apply this to other designs.

BP130: MICRO INTERFACING CIRCUITS BOOK 1 $9.00
Aimed at those who have some previous knowledge of electronics, but not necessarily an extensive one, the basis of the book is to help the individual understand the principles of interfacing circuits to microprocessor equipment.

BP131: MICRO INTERFACING CIRCUITS – BOOK 2 $9.00
Intended to carry on from Book 1, this book deals with practical applications beyond the parallel and serial interface. Real world interfacing such as sound and speech generators, temperature, optical sensors, and motor controls are discussed using practical circuit descriptions.

BP136: SIMPLE INDOOR AND WINDOW AERIALS $7.00
People living in apartments who would like to improve shortwave listening can benefit from this book on optimizing the indoor aerial.

BP155: INTERNATIONAL RADIO STATIONS GUIDE $9.00
An invaluable aid in helping all those who have a radio receiver to obtain the maximum entertainment value and enjoyment from their sets.

BP174: MORE ADVANCED ELECTRONIC MUSIC PROJECTS $12.00
Complementing Book PB74, Electronic Music Projects,

BP174 provides projects, such as a flanger, a phaser, mini-chorus and ring modulators, percussion synths, etc. Each project has an Introduction circuit diagram and constructional notes.

BP179: ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF ROBOTS $12.00
The main stumbling block for most would-be robot builders is the electronics to interface the computer to the motors, and the sensors which provide feedback from the robot to the computer. The purpose of this book is to explain and provide some relatively simple electronic circuits which bridge the gap.

BP180: ELECTRONIC CIRCUITS FOR THE COMPUTER CONTROL OF MODEL RAILWAYS $9.00
Shows how home computers can easily be applied to the control of model railroads and other quite sophisticated control. A variety of projects are discussed as well as circuits for train position sensing, signal and electric points control, etc.

BP185: ELECTRONIC SYNTHESIZER CONSTRUCTION $9.00
With this book a relative beginner should be able to build, with a minimum of difficulty and at a reasonably low cost, a worthwhile monophonic synthesizer and also learn a great deal about electronic music synthesis in the process.

BP192: MORE ADVANCED POWER SUPPLY PROJECTS $8.00
Robert Penfold.
A companion to BP76, this book covers switched mode supplies, precision regulators, tracking regulators, computer- controlled supplies, etc.

BP225: A PRACTICAL INTRODUCTION TO DIGITAL ICs $7.00
This book deals mainly with TTL type chips such as the 7400 series. Simple projects and a complete practical construction of a Logic Test Circuit Set are included as well as details for a more complicated Digital Counter Timer project.

BP233: ELECTRONIC HOBBYIST HANDBOOK $15.00
A single source of easily located information: colour codes, pinouts, basic circuits, symbols, etc.

BP239: GETTING THE MOST FROM YOUR MULTIMETER $9.00
This book is aimed at beginners in electronics. Using the simple component and circuit testing techniques in this book the reader should be able to confidently tackle servicing of most electronic projects.

BP240: REMOTE CONTROL HANDBOOK $12.00
Includes remote control systems, transmission links, digital electronics, methods of control, decoders, etc.

BP245: DIGITAL AUDIO PROJECTS $11.80
This book takes a look at the basic principles involved in converting an audio signal into digital form and then converting it back to an analogue signal again. It also contains practical circuits for constructors to build and experiment with.

BP247: MORE ADVANCED MIDI PROJECTS $11.80
This book includes circuits for a MIDI indicator, THRU box, merge unit, code generator, pedal, programmer, channeliser and analyzer.

BP248: TEST EQUIPMENT CONSTRUCTION $11.80
This book describes in detail how to construct some simple and inexpensive, but extremely useful, pieces of test equipment.

BP249: MORE ADVANCED TEST EQUIPMENT CONSTRUCTION $14.00
This book carries on from BP 248, TEST EQUIPMENT CONSTRUCTION, describing some slightly more advanced projects for readers who have a certain amount of experience at project construction.

BP251: COMPUTER HOBBYISTS HANDBOOK $23.80
This book provides a range of useful reference material in a single source so that it can be quickly and easily located. The subjects covered include microprocessors and their register sets; interfacing serial, parallel, monitor, games and Midi ports; numbering systems; Midi codes; operating systems and computer graphics.

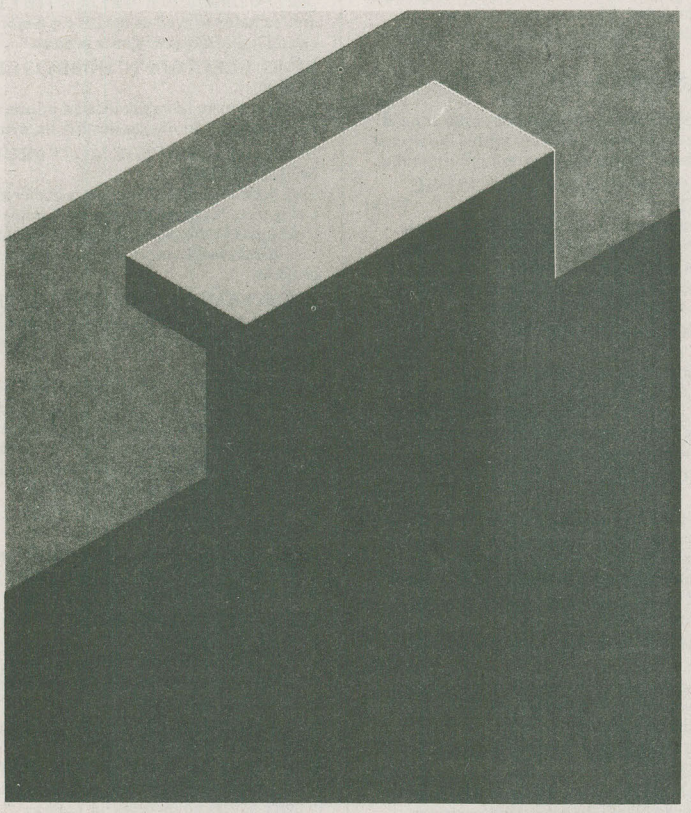
BP256: AN INTRODUCTION TO LOUDSPEAKERS AND ENCLOSURE DESIGN $11.80
This book explores many types of enclosures and drive units. Crossover units are also explained, the various types, how they work, the distortions they produce and how to avoid them.

BP257: AN INTRODUCTION TO AMATEUR RADIO $14.00
Topics covered in this book include the basic aspects of the hobby, such as operating procedures, jargon and setting up a station. Technical topics include propagation, receivers, transmitters and aerials etc.

To order your Babani Book fill out the order form on the following page ...

IC 555 Projects

E.A. PARR



Babani Book of the Month

Every so often a device appears that is so useful that one wonders how life went on before without it. The 555 timer is such a device.

It was first manufactured by Signetics, but is now manufactured by almost every semiconductor manufacturer and is inexpensive and very easily obtainable.

Included in *IC 555 Projects* by E.A. Parr are Basic and General Circuits, Automobile and Model Railway Circuits, Alarms and Noise Generators as well as a section on the 556, 558 and 559 timers.

IC 555 Projects by E.A. Parr would be an invaluable addition to the library of all those interested in Electronics.

IC 555 Projects by E.A. Parr normally costs $11.84. This month only, with the Babani Book of the Month discount, the price will be $8.85. Order yours today. ❐

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Field Day, *Cont'd from page 31*

mock disaster (another area where hams are welcomed) and also provide supplementary communications for the fire departments, etc.

What Happens

Some radio clubs use the same site each year for their field days. In true emergency fashion others change every year. The first step is to designate a location and man it with equipment. Field Day affords the opportunity to see many different radios and communications taking place simultaneously. This will give you a feel for the true range and versatility of this hobby. Site and equipment chosen, you are ready to go.

Some clubs, depending on their size, may establish a very rigid timetable to ensure there is someone operating through the entire weekend. Other groups don't have enough active hams to take this approach or they are more comfortable with a relaxed atmosphere.

In the true nature of emergencies, antennae are to be constructed and erected. Equipment is to be powered through auxiliary means and everyone should have a job to do. Power the radios and call CQ FIELD DAY. Log your contacts and have fun! Remember, although you may not be a licensed operator, you are permitted the privilege of operating the equipment under supervision of other licensed hams! If you are offered the microphone don't be shy — it could be the beginning of a lifelong friendship!

Over my 14 years in this hobby I have met some very interesting people. There are only two conditions that need to be met if you are going to talk to someone on the other side of the world. Number one — they must be on the air at the same time as you. Number two — your signal must bounce in their direction. We can predict certain radio patterns according to the weather or solar flare activities but nothing is guaranteed. What happens on field day more often than at any other time is the abundance of people world-wide on the air at exactly the same time thus increasing the chances for worldwide communications. One winter's evening shortly after I received my license I tuned the radio to the 10 metre portion of the band. It was dead silent. I decided to call and see if anyone was listening. In the next hour I chatted with a retired business man from Canada living in Haiti, a pharmacist in Edmonton who had once lived in Mitchell, a fisherman from Minnesota and a ham from Kitchener. All knew exactly where Mitchell was-except for the ham from Kitchener. Small world.

Stringing a 20 Metre Dipole

This Year

My daughter was planning a grade eight party for everyone in her class the weekend of field day. I still wanted to attend the BLUEWATER CLUB site if even for a few short hours. I set out about 11:30 AM on Saturday, June 22nd. Arriving at the site I couldn't help but notice Will was up the tree and Bill, VE3JEC, was on the other end of a 20 metre antenna. In Bill's words it was "..made out of some old scrap wire and home brew insulators..." in true field day tradition. Before I left the contacts ranged from Florida to British Columbia on this scrap metal masterpiece.

The pot of chili was ready as I arrived and although mild by some standards I still have no sensation in my lower lip. Field day is good fun; there is plenty of food and an opportunity to communicate with others worldwide doing exactly the same thing. There are definitely no barriers in this hobby.

While at the site I met newly elected BLUEWATER PRESIDENT Stan - VE3VAC - who works for CKNX TV as their senior audio man. Stan has 18 receivers in his shack and he has a computer program to decode Russian cryptic but that's another story..... ❐

Feature

Understanding Sound Waves

Electronic Experiments Using Analog Circuits For Sound Measurement And Control

by Donald Wilcher

Sound allows us to communicate with those about us. The sound of music affects us psychologically using our moods and emotions. The reproduction of sound by radio, movies, record players (i.e. CDs), telephones, televisions, and tape recorders are big business today. Supersonic and ultrasonic are commonly used words to describe very powerful and high-energy sound waves. The so called "sonic boom" is a very powerful sound wave that may strike the earth with a shattering blast when a jet plane pulls out of a supersonic drive.

The material that is to be presented will described in detail the composition and effects of sound. Methods for detection and control will be explained followed by construction projects in which the reader can experiment, thereby understanding the concepts and principles discussed and serving as a final wrap up to this fascinating field of science.

Physics Of Sound

Sound is composed of longitudinal mechanical energy waves. They can be propagated in solids, liquids and gases but unlike electromagnetic waves, not in a vacuum. Sound propagates faster in liquids and solids than in air. Water cannot be compressed so sound waves propagate by means of lateral motion of the molecules, in a manner similar to wind waves on the surface of a lake. In water, sound is a transverse wave (waves which vibrate at right angles to the direction of propagation of the wave's motion). Sound waves are confined to a range of frequencies which can stimulate the human ear and brain to the sensation of hearing. The audible hearing range is defined from 20Hz to 20KHz. This range is the average response of a high fidelity stereo amplifier, though one can seldom hear sounds as high as 20 KHz. This frequency response corresponds to a wavelength range of 5/8" to 55 ft. (1.7 cm to 17 m, metric). As one becomes older, less and less can be heard at the hight end of the range.

Infrasonic Waves

As mentioned earlier, sound is comprised of longitudinal mechanical waves. A longitudinal mechanical wave whose frequency is below the audible range is called an infrasonic wave (Infrared light waves are waves below red light).

The longest-wavelength infrasonic waves can affect the normal human ear (20Hz). They are a thousand times as long as the shortest wave to which the ear is sensitive (20KHz). The longest light waves (red) that can affect the eye is less than twice as long as the shortest waves (violet). The ear, however, has a range of ten to twelve octaves: the eye range is but one octave. NOTE: The interval between two frequencies, one of which has twice the frequency of the other, is an octave, e.g., 400Hz to 800Hz.

Infrasonic waves of interest are usually generated by large sources, such as an earthquake. Without resorting to such upheaval as an earthquake, you can sense these kinds of waves while driving behind a large trailer/truck on a highway. The large frontal surface are of the truck (which often is flat) buffers the wind and sets up infrasonic waves which are impressed on the ears as feeling sensations rather than as sound sensation. This buffering also makes steering the car more difficult.

Methods for detection and control will be explained followed by construction projects...

As a simple experiment in infrasonic waves, take a trip in a fast elevator in a tall building. You would be going from a position of high air pressure (ground floor) to a position of low air pressure (the highest floor reached) in perhaps 30 to 60 seconds. In order to get a full wavelength, just double the time. Frequency of a wavelength is related to the period (time) by the equation:

$$f=1/T$$

Where

f is the frequency in hertz

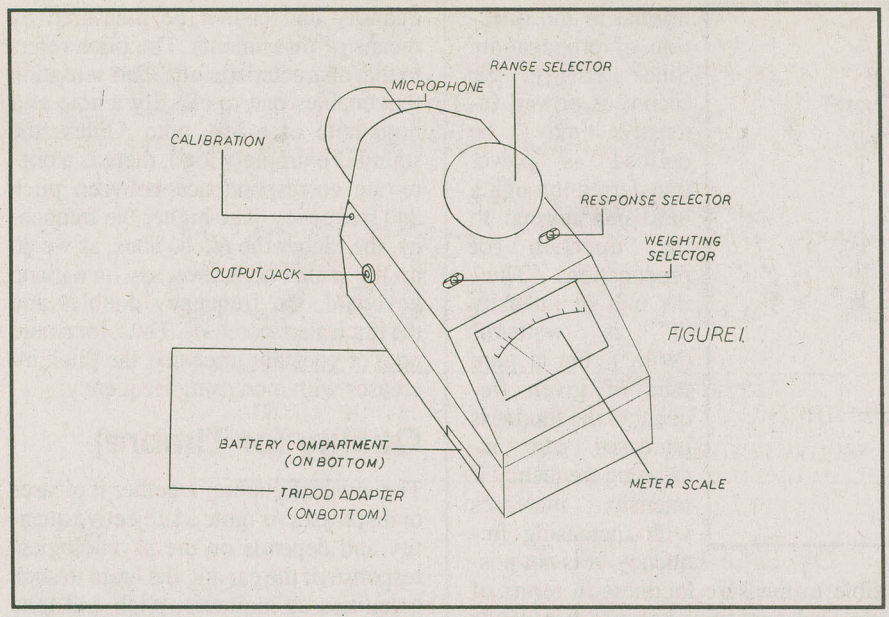


FIGURE 1.

T is the period of time in seconds

Ultrasonic Waves

Frequencies that are above the audible range (>20KHz) are called ultrasonic waves. Ultrasonic waves may be produced by a quartz crystal as is done in certain security intrusion detectors. The devices flood a room or area with silent sound in order to detect an intruder by means of beats set up by the moving object and the original signal. They normally operate at 40KHz and of course cannot be heard by the human ear.

Periodic Waveforms

Waveforms which are fairly periodic or waveforms which consist of a small number of approximately periodic components give rise to a pleasant sensation, for example, musical sounds. Sounds whose waveform are very irregular, however, are heard as noise.

Noise

Noise can be represented as a superposition of periodic waves, but the number of components is very large. For example, the noise or static you hear on an AM radio is impulsive in nature, since you hear only a few sferics (atmospheric interferences) per minute, except when there is a storm in the local area with lightening present. The noise you hear and see on a TV set tuned to an unoccupied channel is known as white noise and is made up of many components of audio sine waves. In the same manner, white light is the presence of all frequencies of colour. This, however, is not why the TV screen is white when there is no TV signal coming in. It is due to the type of TV transmitter modulation used in the U.S. and other countries. In the U.S., when an automobile goes by, ignition noise causes black spots to walk across the TV screen. But in England, where the modulation method is reversed, white spots are seen to walk across the screen when an automobile with ignition noise passes by.

Temperature And Sound

At a temperature of 70 degrees F, the speed of sound in air at sea level is 1130 feet-per-second. Since temperature affects the speed of sound, at high temperatures the molecules transmitting the sound (air or metal, etc.) move faster and the speed of sound is increased. The speed of sound is 1088 feet per-second at 32 degrees F (freezing point of water) because the molecules are slowed down.

Beat Notes

When two sounds of exactly the same frequency meet, they travel through the air together and form a much stronger or weaker wave then either of them alone. When the two waves are exactly in phase, the maxima and the minima occur at the same time and the two signals are stronger than one by itself. This is called "constructive" interference. When the two signals are exactly out of phase, that is, the maxima of one signal occurs at the same time as the minima of the other signal, we have "destructive" interference and the two waves tend to cancel each other.

If the two waves are of slightly different frequencies, the new wave is sometimes reinforced and diminished, but they never completely cancel each other.

Components of Sound

Although sound is a longitudinal mechanical wave that can be propagated in solids, liquids and gases, the makeup of this energy wave is comprised of three parts. They are Loud-

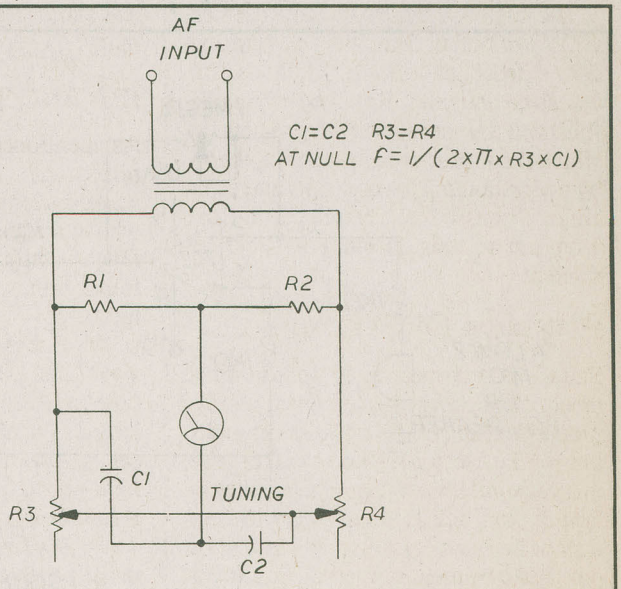


FIGURE 2.
AUDIO FREQUENCY METER

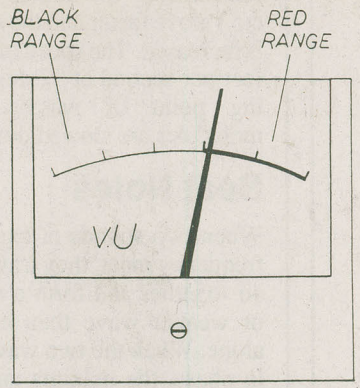


FIGURE 3.
VOLUME UNIT METER

ness, Pitch, and Quality (or Timbre). Musicians rely heavily on these components because the quality of their products (music) determines the amount of profit made on the recorded material. This section will focus on these three key elements and will explain how they interrelate with each other.

Loudness

The psychological sensation of loudness in the human ear is intimately connected with the intensity of the incident sound wave. The intensity of a sound wave is equal to the energy crossing per unit area per second. The area being normal to the direction of propagation. Since energy per second is power, intensity may be defined as power transferred through a unit area normal to the direction of propagation. Thus, the unit of intensity "I" is watts/m^2 (W/m^2). For a pure tone of given frequency, the loudness increases with increasing frequency if intensity increases with increasing frequency. It is not possible to measure loudness in terms of physical quantities because it depends upon the response of the ear and the judgement of the individual. For example, two or more observers can easily agree that two sounds are almost equally loud, but they will rarely agree that one sound is twice as loud as another. The loudness of the two sounds may be harder to compare if the frequencies of the two sound sources differ widely.

Pitch

Pitch is another psychological property of sound that is related to frequency. Just like loudness it is a subjective quantity and cannot be measured by means of instruments. The pitch refers to that characteristic of sound sensation that enables one to classify a note as a high note or a low note. Unless the sound is extremely loud, there is a one-to-one correspondence between pitch and frequency. The higher the frequency, the higher the pitch. Thus, as we go up the scale one octave, say on a piano keyboard, the frequency doubles and the pitch also increases. Thus, for a pure note of constant intensity, the pitch increases with increasing frequency.

Quality (or Timbre)

The musical quality, whether it pleases or displeases, is quite a subjective quantity and depends on the psychological response of the ear and the brain to such quantities as loudness, pitch and tone quality. Two of these quantities have been discussed previously; tone quality will be explained in the following paragraph.

If a musical instrument could be made that had only the fundamental frequency and constant intensity, it would not produce a pleasant musical sound. The tone quality of any musical sound is determined by the number of overtones and their relative intensity.

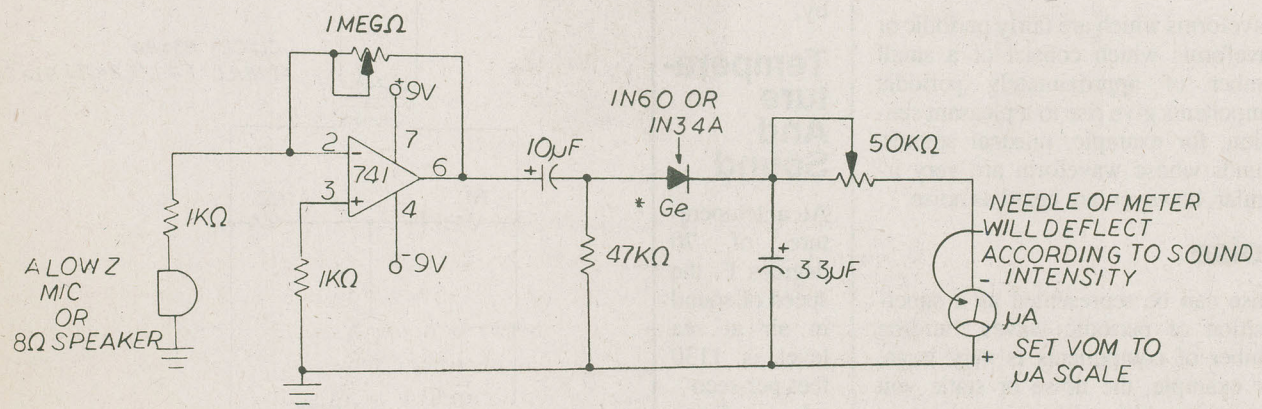
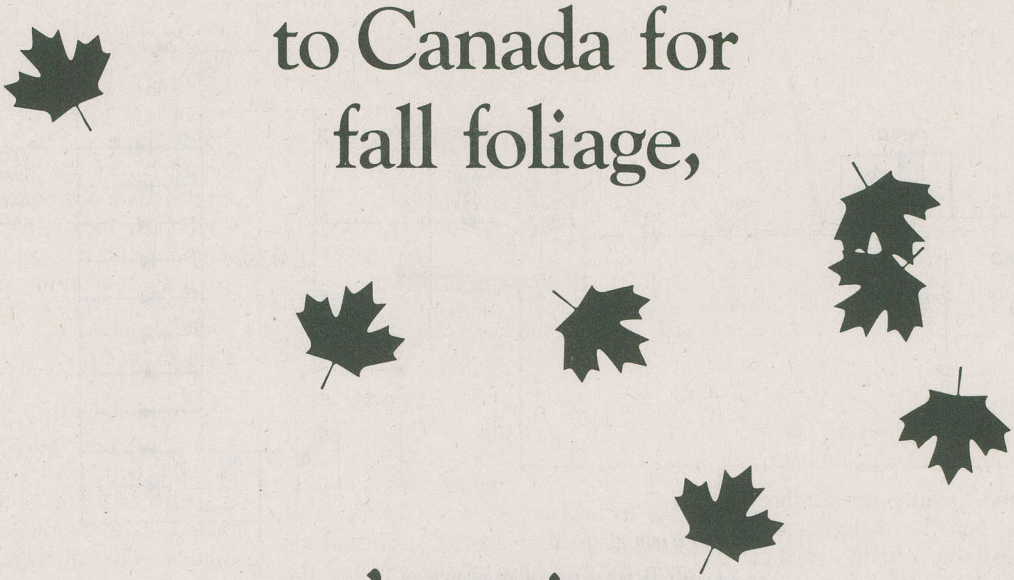
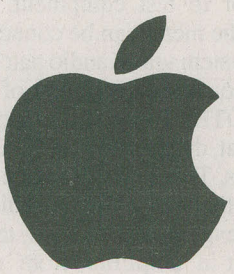


FIGURE 4.
SOUND LEVEL METER

Some people travel to Canada for fall foliage,



we're going to Toronto for the Macintosh harvest...



Mark your calendars early!

It will be a bumper crop at Macworld Expo/Canada, from October 8 – 10, at the Better Living Centre in Toronto. You can see the latest in Macintosh technology, and get great deals on hardware and software for the coming year. Whether or not you use the Mac, it's the one event you can't afford to miss! For information about exhibiting at or attending Macworld Expo/Canada, call (416) 581-8797 or the Macworld Expo/Canada hotline, (416) 591-2447.

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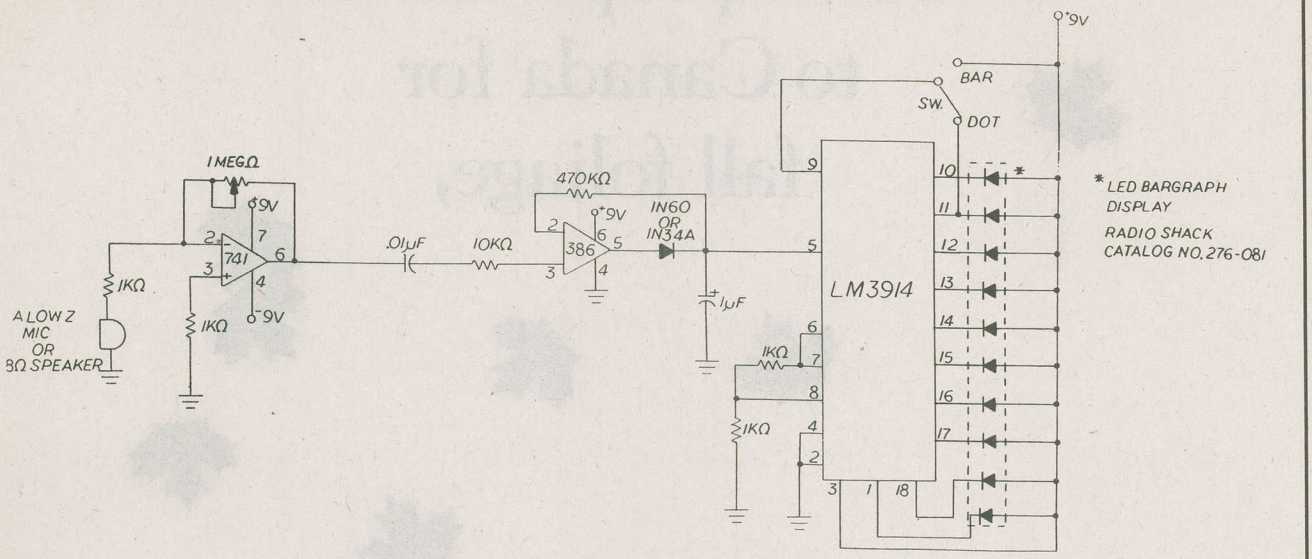


FIGURE 5.

SOUND LEVEL METER WITH BARGRAPH DISPLAY

Sound Detection and Measuring Devices

Now that the fundamentals of sound in terms of composition and elementary science have been explained, how can this physical parameter (sound) be measured and used to control "real" world devices? Well, the following paragraphs will explain how measuring instrumentation may be used for sound detection and control of infrasonic sound waves.

Sound Level Meter

Basically, a sound level meter is a portable instrument for measuring the intensity and other characteristics of sound. To best describe the versatility of this instrument, the Tandy Corporation's sound level meter will be used as an example to explain the meter operation.

As shown in Figure 1, the Realistic Sound Level Meter is an extremely versatile device for measuring sound intensity (W/m^2) in just about any acoustic environment — loud or soft, high pitch, low pitch or broad band, intermittent or continuous. This unit has scores of practical applications for professional and home use: measuring noise levels in factories, schools, offices, airports, checking acoustics of studios, auditoriums, and home stereo installations.

The precisely calibrated meter features a large, easy-to-read indicator for taking quick measurement anywhere.

This sound level meter has a phono type output jack for connection to a stereo or to test equipment. For example, the meter can be connected to a stereo system via an audio patch cord to the aux or high level input of the system. NOTE: The meter response will not be flat, due to the A and C weighting networks. The RANGE selector switch is set so that a maximum needle deflection is never greater than +4, to prevent the built-in amplifier from clipping. The A weighting is used for voice recording/measurements and the C weighting for full-range musical material. A motion detector will shortly be constructed using the output jack feature of the sound level meter and a few associated electronic components.

Audio Frequency Meter

An instrument for measuring frequencies in the audio frequency spectrum (20Hz to 20KHz) is known as an Audio Frequency Meter. Three types of meters are commonly used: analog, digital, and the bridge. The analog type frequency meter gives direct indications of frequency on the scale of a D'Arsonval meter. The usual range that can be measured with this unit is 20Hz to 100KHz. The digital frequency meter gives direct indication of frequency by means of a readout of lamps or LED/LCD displays. Frequency range for this meter is 1Hz to 15MHz. This meter can be used in radio frequency measurement applications as well. The bridge type audio frequency meter consists of a frequency sensitive bridge such as a Wein Bridge, with a null indicating meter. The operator of this device balances the bridge and reads the unknown frequency from the dial of the balance control. Figure 2 illustrates the wiring diagram of the bridge type audio frequency meter.

Volume Unit Meter

A volume unit (VU) meter is an instrument for measuring the root mean square (RMS) volume level in an audio amplifier. The VU meter is calibrated in decibels relative to +4dBm. Most VU meters are fast acting instruments with just enough damping to allow easy reading. In a sophisticated stereo amplifier, each channel has a VU meter. The scale is marked off in black and red numerals with a black and red reference

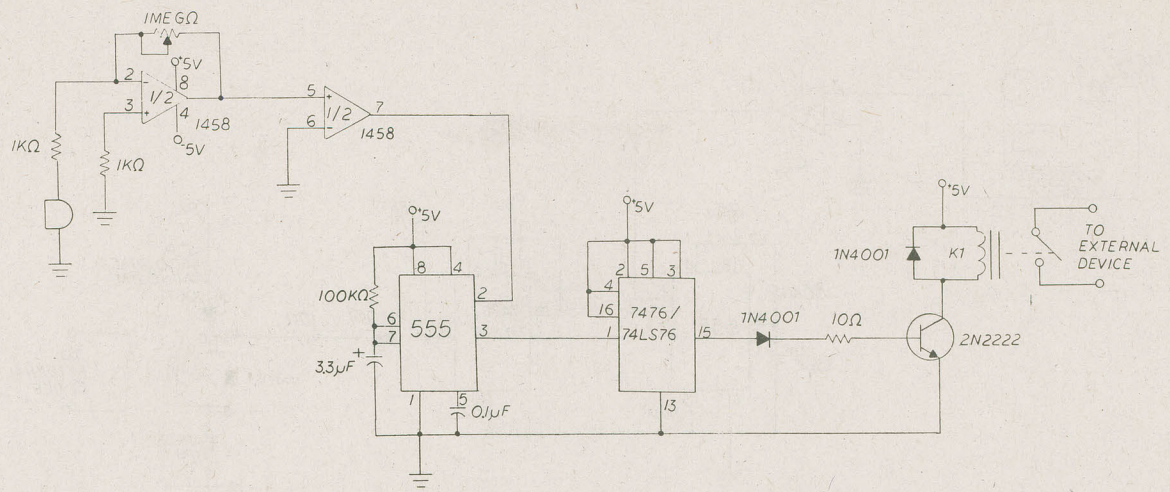


FIGURE 6.

VOICE / SOUND ACTIVATED SWITCH

line. The amplifier gain should normally be set so that the meter needle never enters the red range indicating that distortion is likely to occur on audio peaks. Figure 3 shows the face of a typical VU meter.

Motion Detector

A motion detector is a device for sensing the movement or stopping of a body such as a rotating shaft or a moving car. As discussed earlier, ultrasonic waves along with a quartz crystal can be used for detecting such motion. By using the combination of ultrasonics and a quartz crystal, an intrusion alarm can be constructed.

Experimental Sound Detection/Measurement and Control Circuits

Now, here comes the fun part of this article, electronic experiments and projects. The projects that will be explored in this section are, a sound level meter (both an analog and a LED Bargraph Display unit), a voice/sound activated switch and an experimental motion detector. So, warm up the soldering iron and blow the dust off of those electronic parts and get ready for some old fashioned electronics tinkering with a "high tech" twist.

A Sound Level Meter

Figure 4 shows the schematic diagram of an analog sound level meter. The 741 op-amp operates as an inverting amplifier. It amplifies the voltage (sound) microphone. The speaker or microphone is used to detect any sound or noise input signal. The feedback resistor, a 1 MΩpotentiometer can be used to vary the gain of the amplifier — it determines the sensitivity of the amplifier circuit. The 10μf and 47kΩ resistor form a timing circuit for the meter deflection response. This circuit establishes the timing between each sound voltage peak level and the analog meter showing the response. The germanium diode and the 3.3μf capacitor provide a rectification and filtering network for the meter's needle deflection. The 50K pot provides meter sensitivity to the flow of current that it is monitoring.

Once the circuit has been constructed, both the 1MΩ and 50KΩ pots should be adjusted for best sound level detection response reading on the meter. NOTE: Adjust the 50K pot so that maximum meter response will not peg the needle of the meter. If a professional sound level meter is available, see if you can calibrate this circuit to the standard unit. Try various locations around your home and see what the sound level is at the location of measurement. Record your results in a log book and make a plot between location versus sound level intensity (dbM).

Sound Level Meter With an LED Bargraph Display

This circuit in Figure 5 operates in a similar fashion to the previous circuit with the exception of the output display unit. This circuit will illuminate the appropriate LED(s) depending on the sound level signal received at pin 5 of the LM3914 Bar/Dot Display IC. This chip was designed to function in a logarithmic manner based on the concept of decibels (dB). Upon the input signal being received at pin 5 of the chip, the device will convert the signal into its equivalent log number. Therefore, the LED Bargraph will display a true dB reading. The LM386 IC provides further amplification to the LM3914 IC. The germanium diode and 1μf capacitor provide rectification and filtering of the output signal from the

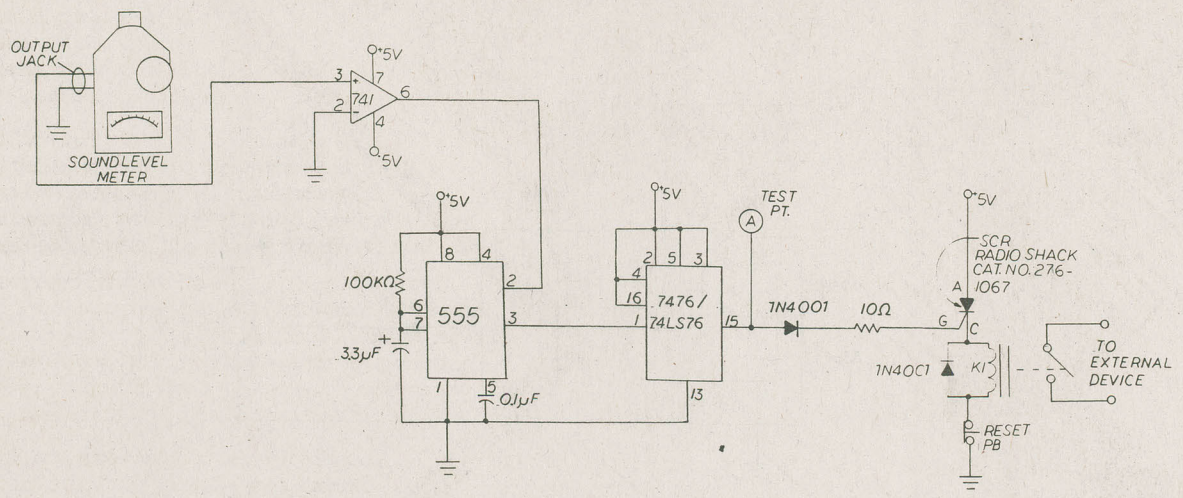


FIGURE 7.

AN EXPERIMENTAL MOTION DETECTOR

LM386 chip NOTE: If the switch is in the BAR position, several LEDS will be illuminated according to intensity of sound level. If the switch is in the DOT position, each individual LED will be illuminated according to intensity level.

A Voice/Sound Activated Switch

With electrical impulses being produced by the microphone via sound detection, the 1st 1458 op-amp is configured as a non-inverting pre-amplifier. This amplifier will amplify the signal to a level compatible with digital logic which will do the switching and control of external devices. The 2nd 1458 op-amp is used as a square wave converter. The pulse produced by the converter is compatible with the 555 Timer and the 7476/74LS76 J-K flip-flop circuits. The 555 IC is wired as a one-shot timer to provide a delay, thereby allowing the 7476 adequate time in receiving and processing the square wave input pulse. The delay established by the 555 is important because the output latch circuit (7476) requires a few milliseconds in order to receive and process this data for switching applications. The 555 circuit is configured for a delay of 363 milliseconds. The 7476 chip upon receiving this 363mS signal will then turn on or off an external device via the transistor relay driver. The J-K flip-flop was used as opposed to using just a transistor relay driver because once the output signal of the J-K flip-flop is high it needs to remain in that state until it receives another input pulse from the one-shot timer. The transistor relay driver connected at the output of the flip-flop IC is used for switching external devices (e.g. motors, lamps, robots, etc.) on or off. Figure 6 is the complete diagram of a voice/sound activated switch.

An Experimental Motion Detector

The circuit shown in Figure 7 is of an experimental motion detector. The circuit functions exactly as the voice/sound activated switch with the exceptions of the sound level meter and the SCR relay driver circuit. The sound level meter acts as a pre-amplifier by detecting the sound via microphone and then amplifying the sound and sending it to the square wave converter circuit via the output jack of the meter. The 555 IC and the 7476/74LS76 establish the time delay and output latching functions respectively. Upon receiving a flow of current into the gate of the SCR, the relay is energized and remains energized until the RESET PB is depressed, at which time the driver circuit is ready to switching on the external alarm. In order to reset the circuit, the following steps are required:

1. Clap your hands or make a loud noise so that the sound level meter can detect it.
2. By connecting a volmeter or using an LED at TEST PT A, there should be no voltage or LED on.
3. Depress the RESET PB.
4. The circuit is ready for detection.

Sensitivity of this circuit is adjusted using the Range Selector Switch for the correct dB level on the meter.

Summary

It is hoped that the material presented in this article has furthered your knowledge about sound and the various methods used to monitor, measure and control this natural energy form. As a design challenge, see if you can interface some of the circuits that were discussed to a personal computer for data logging the dB levels measured in various environments. GOOD LUCK!!! ❐

***de Forest**, cont'd. from page 30*

de Forest found his chair behind the defendant table, the judge instructed the jury to differentiate between fraud and what company officials — de Forest included — might have felt as legitimate optimism for an infant industry.

When the jury returned, it had found guilty two company directors who were eventually imprisoned for two and a half years. De Forest, however, had been found not guilty on three of the four charges. On the fourth, the jury had been undecided. It was determined that the scientist had been promoting the possibilities of his wireless design, and the awesome potential it represented.

The jury probably decided correctly. Early in his life, de Forest had recognized the great future in the Audion and the power of the radio age. As early as 1908, he told the *Times* that his wireless telephones would someday allow anyone in New York city to hear operas sung in the city's theatres. One day, he said, music, news and advertising would be brought into every home.

"The apparatus will be so cheap that it will be in the reach of everyone," he said. And he saw the wondrous consumer simplicity of the radio age. "....All the subscriber will have to do is put up a [receiver] flagpole on his dwelling." ❐

Tornado Watch....It Doesn't Just Happen in Kansas

by Bob Havens, VE3IYO (VE3MPS)

Sky Warn....A Little History

One advantage of living in the cold, white north is the fact that we are fairly devoid of carnage caused by natural disasters. Our most frequent challenge is that posed by winter blizzards. Even with their potential for danger, there is an element of excitement and tranquillity that comes with being snowbound. Not so with severe thunderstorm activities accompanied by the possibility of tornados! Terrifying is the best way to describe this combination.

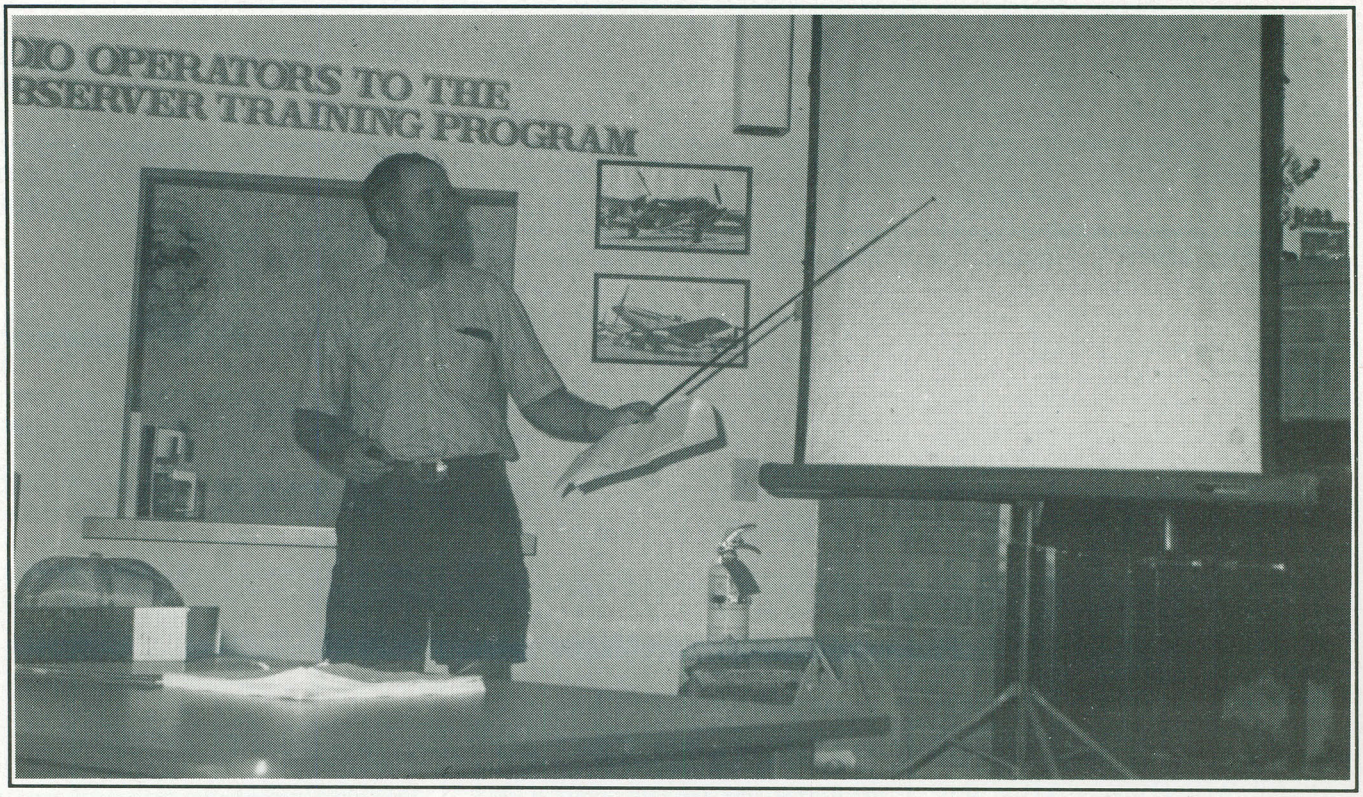
Countries where earthquakes, volcanic activity or typhoons happen regularly there is a plan of action. Our neighbours to the south have faced the horror of tornados long before OZ. They use amateur radio operators as official tornado spotters. You may find it surprising to learn that in spite of ALL our modern technology we have NO absolute method of verifying tornado activity except via actual sightings. This army of volunteer personnel has been in operation below the border for over 30 years. They provide warning of immanent danger which has saved many lives.

Canwarn....Why Now....Why Not Sooner...

Although many would believe we are experiencing more tornado activity there is not proof to support this claim. Damage and injury is on the rise. How is this possible if the frequency of severe weather is not increasing?

Drive around any large city you have not visited in the last few years. What was urban is now city and what was country in now urban. We are a country undergoing growth and development. Even more to our disadvantage is that we like to build in the areas which are path lines for tornado development. A tornado which cuts a path through a 50 hectare field will not likely draw much attention. Ask Woodstock or Edmonton residents what happens when that same tornado crosses paths with man made structures.

It is both good fortune and good timing that we now have more hams than at any other time in history. Tornado watch programs in themselves would have been good reason to restructure our amateur radio system. In areas where we would benefit from tornado spotters there are still not enough bodies present to yet make it work. If we had wanted to begin the program sooner it is doubtful we would have had the resources to make it work!



John Hoekstra, London Weather Office

Interested Hams

Two Options...

You do not need to be an amateur radio operator to assist the weather offices as per severe weather problems. One program involves being a SEVERE WEATHER WATCHER and the other directly involves amateurs as TORNADO SPOTTERS. As you can well imagine, we are not encouraged to roam the countryside just hoping to encounter a tornado! Many, many amateurs are equipped with radios in their vehicles and CANWARN offers them an outlet to report any severe weather pattern or tornado sighting as they go about their daily tasks. In the past, you could report such phenomena but your message would have to be relayed and during a tornado touchdown every second is precious. With the CANWARN system in place, the weather office is monitoring these calls and is in direct link with a NET controller to establish the path and severity of the weather as it happens! The SEVERE WEATHER WATCH program is still in effect but you must stop and get to a phone. From there your message needs to be relayed to local authorities. You can see how this can consume valuable time which is needed to save lives. If you are not a ham operator but do travel or have time to weather watch over the summer contact your local weather office and ask about this program. Some warning is better than no warning!

Canwarn....How It Works...

The CANWARN system links an army of amateur radio operators directly with the weather office through a net controller on an agreed frequency. The information is current and immediate. Even if you are not a licensed ham it would seem that now would be a good time to shop for a radio scanner. This device will allow you to intercept and listen to all emergency traffic from tornado watches to ambulance calls. Visit you local Radio Shack store and ask for a demonstration. Even when there is not severe weather in the area scanners can provide some very entertaining listening!

All amateurs are encouraged to receive proper training as tornado spotters. One evening of your time is all it will take. Even if you lack the proper training check the weather office in your area for a grid map. This map will help track storm or tornado paths.

Let's assume that you are driving along and severe weather is developing in the direction you are travelling. You have a 2 metre radio in your car and the grid map for your area in the glove compartment. You notice the formation of a wall cloud and call this in to the net controller on the radio. You identify your position according to the map as N27 etc. This is a fairly serious development in storm patterns and you would be advised to turn at right angles to the approaching front if possible. If the storm continued to approach and you spotted rotation within the clouds it may be time to leave your car. Too many remain in their vehicles. This can be a tragic mistake. Walk towards the storm so you are between the approaching weather and your car. You do not want it to be blown towards you! Find the lowest spot possible along a ditch area and lay flat until the front passes. The information you have broadcast will already be passed along to radio and TV stations for transmission to the public airways.

Kincardine Presentation

John Hoekstra and Doug Mackinnon came to the Kincardine airport on Thursday, June 27th to educate any and all interested in severe weather phenomena. Both are now licensed ham operators and monitor the VE3LON repeater during weather emergencies. This direct link is a big part of the Frome success story. During late August of last year a tornado struck the small village southwest of London. With the hams hard at work and sightings in the area the population of this small community had a 20 minute warning before the tornado hit! We know 3 families living in the centre of the small village. Although they found the tornado to be a frightening experience they were all extremely thankful that ample warnings came there way!

During the evening we learned of anvil heads, wall clouds and debris columns. What came home most of all to me is the importance of human spotters as tornados are not detectable on radar! Winter storms or heavy rains give sustenance that can be tracked but tornados often spring from areas where there is no rainfall at all! I urge you to attend one of these free presentations if you have the opportunity.

What Comes Next..

Hopefully we will develop a complete network system all linked together with one grid map in the years to come. Small dedicated receivers which can be activated by tone control from the weather offices can be placed in heavily populated schools and work areas. These can provide immediate information which will save lives. Amateur radio is definitely a hobby which continues to serve. ❐

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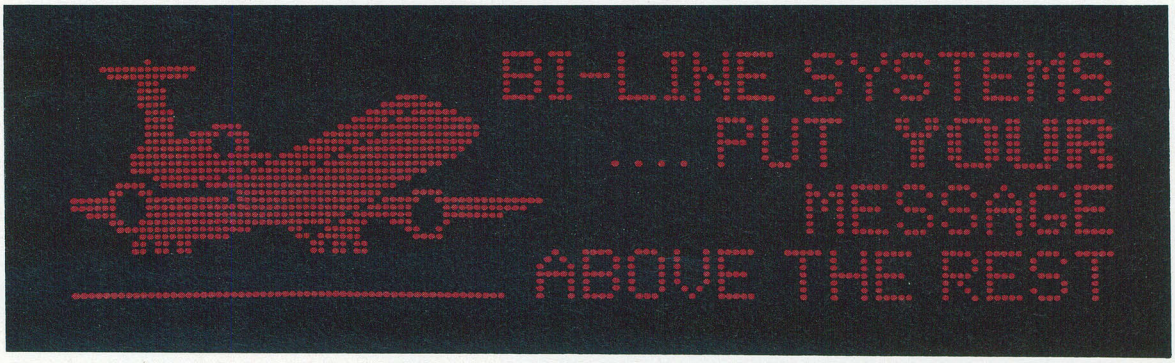

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FLUKE AND PHILIPS – THE GLOBAL ALLIANCE IN TEST & MEASUREMENT

FLUKE® PHILIPS

70 SERIES II

8 New Meters. 8 Old-Fashioned Values.

Introducing Fluke's 70 Series II, next-generation multimeters that meet the increasing demands of your job and your budget.

Consider. At the top of the line, the new Fluke 79 and 29 deliver more high-performance features – capacitance, frequency, a fast 63-segment bar graph,Lo-Ohms range, Smoothing™, faster ranges – than DMMs costing much more.

At the entry level, the new model 70, Fluke's lowest-priced DMM ever, delivers unparalleled Fluke quality at a price comparable to "disposable" meters.

And in between are all the models that have made the 70 Series the most popular DMM family in the world – updated, refined and delivering even more value than ever.

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"BASICS" REDEFINED

No matter which 70 Series II you choose, you get simple, one-handed operation. High resolution. And built-in, go anywhere reliability.

Automatic Touch Hold® – standard on every model – locks the reading on the display and signals you with a beep, automatically updating for each new measurement without a reset. Leaving you free to concentrate on your work, not on your meter.

YOUR BEST CHOICE

Best of all, every 70 Series II is a Fluke, backed by a worldwide service network and an industry-leading 3 year warranty.

So the next time you're in the market for a new meter, ask for the one that guarantees old-fashioned value. Fluke 70 Series II. For more information call the number nearest you for the name of your Fluke distributor.

Fluke 79 Series II & 29 Series II
$261
4000 Count Digital Display (9999 in Hz & ⊣⊢)
63 segment Analog Bar Graph
0.3% Basic DC Voltage Accuracy
Automatic Touch Hold®
Diode Test, Audible Continuity Beeper
Autoranging, Manual Ranging
Holster with Flex Stand™
Frequency Counter to over 20 kHz
Capacitance 10 pF to 9999μF
Lo-Ohms Range with Zero Calibration
Smoothing™
700 Hours Battery Life (alkaline)
3 year Warranty

79/77/75/73/70 for measurements to 4800 V-A.
29/23/21 for higher energy measurements.
Suggested Canadian list prices for Fluke 70 Series II meters range from $79 to $261. All taxes extra.

FLUKE®